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Wages and Chemical Engineering

IN A country as intensely industrial as the United States wages are a vital part of the economic structure. They determine largely the buying power of the people. Also in a state of industrial prosperity such as prevails in this country at the present time high wages and low costs of production present an apparent anomaly in the light of earlier business conceptions. But in the cycle of industrial production, wages based on productivity rise with increased production efficiency, beget higher standards of living and increased consumption, and ultimately tend to reduce unit costs of production. There is, therefore, nothing inconsistent in the spectacle of high wages and low costs in American industry. The problem is to spread the gospel among the uninformed.

ENLIGHTENED management and progressive labor leadership are alive to the situation. It has not been many years since managers felt constrained to keep wages down in an effort to increase profits. Similarly labor leaders have only recently turned from the doctrine of restricting output so as to increase the number of jobs and insure the security of the workers. Under those conditions wages were based on time service and not on productivity, and all shared alike regardless of their individual contributions to society's welfare. But new conceptions have been forced upon thinking leaders in the ranks of both management and labor. They see that lower wages curtail the buying power of the workers, that unemployment or reduced employment represents waste, that greater productivity reduces costs and makes possible a wider distribution of wealth.

ENGINEERS as a group, but chemical engineers in particular, are in a position to promote sound thinking on this subject, on account of their intimate relation to the problems of production. One of the tenets of chemical engineering is efficiency in production through the substitution of scientific methods for traditional rule-of-thumb practice. Chemical engineering also aims to save time by making processes continuous instead of intermittent. It uses mechanical power wherever possible and seeks special means of utilizing by-products and avoiding waste.

THE net result of these aims when achieved in any industry is to reduce the cost, improve the quality or increase the quantity of the product per worker employed. This in turn makes for a wider distribution and enjoyment of commodities old and new. It raises the standard of intelligence required of the worker and enables him to earn a higher wage. Salaries, too, may be augmented by bonuses and other forms of reward. The measurement of compensation becomes, not the living wage but the capacity of the worker to contribute to more efficient production and wider distribution of the products of industry.

CHEMICAL engineering thus has a definite influence on individual and national income, and the chemical engineer unconsciously becomes an important factor in industrial prosperity. Whether devising a new process, inaugurating a new industry or sitting in consultation on a sick business he influences the wages of the worker. And it is a safe guess that in his efforts to reduce costs and increase profits he will look first for unsuspected leaks and losses, inefficiency and waste before he considers as a last resort a reduction in wages. As a factor in promoting and maintaining industrial prosperity, the chemical engineer enjoys an exceptional opportunity for service.

Construction Field Needs New Materials

PRODUCTS of chemical engineering industries are rapidly becoming of greater importance in the building construction field. Pyroxylin lacquers and artificial resins are now widely used for many decorative and protective purposes. Artificial fiber products are beginning to compete with natural weaves. New types of insulation and sheathing are finding a ready acceptance. Gypsum and magnesite are being made into many new and useful forms.

But in general this has all been the result of pioneering by civil engineers and architects, who have kept a sharp lookout for materials used by other industries which could be adapted to their own needs. Little has been done by chemical engineers along this line. Instead of studying the building construction industry's wants, such developments have been left largely to chance.

However much such a policy may have been justified in the past, the present calls for close and intelligent study. New developments in building construction are coming rapidly. Such factors as the increasing scarcity and higher price of lumber and the great and continued advance in construction labor costs are forcing builders to seek materials that are cheaper or that can be employed with less labor. Already the metal industries are reaching out after their share of this business. If the chemical engineering industries are to participate, it is high time that active preparations to do so are commenced.

Increasing Solidarity in the Fertilizer Industry

FERTILIZER nitrogen prices are decreasing. The present surplus of acid phosphate represents production for an anticipated but unrealized increase in sales for the present year. Over 700 grades of fertilizer are made but barely 50 of these are of enough importance to represent one-quarter of one per cent of the business of the industry. These and many other important technical facts were evident from the proceedings of the National Fertilizer Association in its recent annual meeting. But more important than these technical facts is the very evident improvement in morale of the industry.

The visitor in a home seldom sees conspicuously the little differences of opinion between father and mother or much of the quarreling of the children, but it does not take a very keen individual to determine when strained relations exist in the family. Hence an outsider visiting the fertilizer industry during its convention may be pardoned for saying that the strained relations which could be noted in many of the earlier conventions seemed very happily absent this year. Apparently the preaching of the leaders of the business against ruthless cut-throat competition and a realization by the industry as a whole that competition need not mean personal enmity are affording decided improvement in association relationships.

The 1926 convention was notable in another way, too. It demonstrated more than any earlier convention that the industry is serious in its purpose to go to the bottom of its problems. Such fundamentals as proper cost keeping, unwarranted and unneeded credit, evasion of sound soil fertility problems, and like ideas were frankly faced in these sessions. The industry apparently is no longer willing, ostrich like, to bury its head in the sands of ignorance. It does not claim to be altogether out of the wilderness, but it is willingly following its Moses, frankly facing the economic and technical facts as it finds them.

Not a little credit should be given to the officers and directors of the Association for the progress which is being made. And the greatest appreciation which can be shown by the industry itself will be a cordial support of these officers in working out the six major recommendations presented by President Carter for the next year's work. Reduced to their lowest terms these recommendations are: simplified practice, proper cost keeping, a study of the agricultural co-operative movement, improved soil fertility service, full and current statistics for the industry, and a never ending boosting for increased use of fertilizer.

Attention of Mr. Wayne B. Wheeler

WE DO NOT wish to add to the worries of the harassed Mr. Wheeler and his zealous guardians of prohibition, but we feel it our duty to bring to his attention a matter of very serious concern. Pure grain alcohol, the very essence of demon rum, has actually been recovered from bread in a Paris bakery! M. Lindet, a well-known and distinguished scientist, recently described his successful experiments in a communication to the French Academy of Agriculture, and it would seem only a matter of time, until some unrighteous promoter will attempt to exploit this wicked process in our own good country.

That this would be a serious matter can readily be shown. M. Lindet found that 5 liters of absolute alcohol was produced by the fermentation of the glucose in 1,000 kg. of leavened bread dough. The average American eats 100 lb. of bread a year so that all of our bakeries together must produce about 12 billion lb. a year. With 100 per cent recovery of the iniquitous byproduct of the yeast's activity, these same bakeries might turn out 20,000 gal. of absolute alcohol each day, or 7,200,000 gal. annually. This, in the hands of even the most conscientious of bootleggers, would be the equivalent of perhaps 75,000,000 quarts of an infamous product.

Surely Mr. Wheeler will agree that something must be done about this. Congress should pass a law immediately putting bakeries in the same class as chemical plants and other dens of iniquity. Official sniffers should be appointed to make sure that all the alcohol goes up the baker's chimney and not down the throats of his customers. The new prohibition bureau should see that the baker is properly bonded and that all of his ovens and pans are inspected and licensed in the same manner as a water still in a chemical laboratory. And the baker should be provided with a series of official forms and questionnaires to fill out each day, in order to make sure that bread continues to be his principal source of revenue.

Prohibition is a wonderful institution but there's no reason why it should hang all of its red tape around the neck of the legitimate chemical manufacturer. Why not pass some of it on to the baker?

I. G.—Germany's Industrial Giant

WHEN the Lilliputians first attempted to describe Gulliver it was necessary to piece together a great many observations in order to get a true picture of their gigantic visitor. During the past few months numerous observers have been commenting on the various activities of the great German chemical combine and, perhaps, we shall have to follow a procedure similar to that of the Lilliputians if we are to appreciate the tremendous ramifications of this new industrial giant.

A year ago when the new and more formidable I.G. combination—the Interessen Gemeinschaft Farbenindustrie Aktien-Gesellschaft—was announced it was generally believed that the organization would extend its activities beyond the dye and coal-tar chemical industries. Few of us anticipated, however, the remarkable growth that was to follow in the first few months of the new regime. Nor was it clearly understood that this penetration was to extend to such basic industries as agriculture, fuel and textiles; yet it is along these lines that most progress has been made. A survey recently completed by a Berlin banking house shows that in addition to the facilities of the original I.G. group (Badische, Bayer, Hoechst, Casella, etc.) the combine now includes subsidiary interests operating 5 plants for agricultural products (including 1 sugar factory), 5 plants for miscellaneous chemicals, 10 plants for electrochemical and metallurgical activities, 9 for coal, oil and fuels, 3 for compressed gases, and 5 for textiles—particularly rayon and other synthetic fibers.

Not only are there being marketed many new and highly concentrated fertilizer materials, such as those described by Professor Curtis on page 408 of this issue, but lately through a new subsidiary the I.G. has announced a complete line of trademarked insecticides and fungicides. By a controlling arrangement with the Bavarian Stickstoff Werke, the combine has been able to divert electric power from cyanamide manufacture and has started to experiment with electric-furnace methods for producing phosphoric acid and phosphorus. Energy in excess of 250,000,000 kw.-hr. per year is reported to be available for this purpose.

Coal processing probably holds the eventual solution of Germany's fuel problems and it is not surprising that the I.G. has thoroughly established itself in this field of endeavor. Chemical utilization of coal through carbide and acetylene to make synthetic acetic acid, ethyl alcohol and a wide range of related solvents is already under way. Four synthetic acetic acid plants are said to be in operation and ethyl alcohol and butyl alcohol are both being produced commercially. These solvents, supplemented by nitrocellulose and cellulose acetate produced in I.G. plants, offer an opportunity for ultimately controlling the German lacquer industry.

The synthetic methanol development which has already been the subject of so much discussion is now revived by the talk of a 1,000-ton per day plant. Liquefaction and hydrogenation of coal by the Bergius process comes under I.G. influence through connections with the Bergius Evag Co., and Steinkohlen-Bergen A.-G., and it is confidently expected that this development will some day supply Germany with fuel, gas and lubricating oils. But the most recent of the fuel developments was the plan announced to the shareholders of the I.G. at its annual meeting June 10. *Chemical Age* quotes the Berlin correspondent of the London *Times* to the effect that the dye trust has joined with American and Dutch interests to form the Deutsche Gasolin A-G, through which it is planned to supply the entire German motor fuel market. This move is supposed to represent the culmination of research on synthetic and coal-tar fuels and on the development of anti-knock compounds such as iron carbonyl. Just what this portends for the American petroleum industry is not at all clear but certainly it points toward an ambitious program for the erstwhile dye makers.

Rayon, as the most interesting of recent developments in the textile industry, has not escaped the attention of the I.G., according to one of our informants. Through a working agreement with large English and Dutch firms a joint factory is being built near Cologne to use an improved viscose process developed by an I. G. chemist. The German Bemberg company, manufacturers of cuprammonium silk, are a part of the plan and to complete the picture a new subsidiary, Acetat-Gesellschaft has been organized by two I.G. companies to produce cellulose acetate silk. A daily production of 30,000 lb. of the three different kinds of silk is contemplated. As a part of the rayon development—in fact as a part of all of the newer activities of the I.G.—is the advantageous interchange of raw materials and technical information among the component members of the group.

It is this pooling of knowledge and materials and resources that will afford the principal advantage to the combine. Similar organization of American industry is, of course, impossible under our present competitive system. There remains, however, the promising possibility that broader exchange of technical and commercial information will greatly strengthen many of our industries. If we are to build up in this country an industrial structure that will withstand the organized competition of the German giant, every effort must be concentrated on the goal of increased efficiency. In the strenuous program that lies ahead, chemical engineering must help—as it has in Germany—to knit our industries together into a co-ordinated machine for efficient production and distribution.

A Sane Approach to Corrosion Problems

AT THE recent meeting of the American Institute of Chemical Engineers reported elsewhere in this issue, the authors of and commentators on the several corrosion papers unqualifiedly endorsed a plan of approach to such problems that should receive the consideration of engineers in general. According to this plan, specifications of design, construction and materials receive equal attention.

Until recently almost the entire emphasis was placed on materials of construction, and efforts were made to develop metals having a wide range of usefulness. Laboratory corrosion tests were offered as criteria of resistance. At present, however, there is a definite trend away from the so-called "universal alloys." Special alloys, admittedly having limited application but satisfactory against specific reagents, are rapidly coming into favor. Laboratory tests, although always desirable in a preliminary survey, seem to have lost caste with the chemical engineer. So many disagreements have occurred between the results of special laboratory

tests and ultimate experience in practice, that industrial tests with small sections of equipment are being adopted as a final criterion. Design, which specifies the extent to which similar metals may be used in contact, and the best methods of fabrication are being studied intensively by several of the larger chemical engineering industries. In such studies, the determination of the fundamental factors of corrosion, such as the theory of concentration cells advanced by McKay, has done much to enable an effective combative program to be planned. Some of the methods of fabrication are limited by the particular physical properties of the metal. Among the methods that have been investigated are welding, casting, forging, rolling and drawing. Such working of metals is likely to change their physical constitution to such an extent that the corrosion-resistant properties are entirely different than in the original material. For this reason, the fabricated metal should be restored to its original condition as far as possible before it is put into service.

For recent advances in the development and utilization of corrosion-resistant materials great credit should be given many of the larger industrial laboratories. With the activities now being shown universally, the "combative program" can be expected to proceed at a rapid rate and on a much sounder basis than ever before.

First Consult the Interstate Commerce Commission

RECENTLY a group of explosives manufacturers after a very careful series of tests devised a modified shipping case for their product. The changes were thoroughly tested and it was demonstrated to the satisfaction of both the prospective users of the box and the Bureau of Explosives of the American Railway Association that the new container was superior to the one authorized by the shipper container regulations of the Interstate Commerce Commission. Arrangements were made, therefore, for an elaborate trial of the new case in practical shipping.

A large sum was expended on the new containers. Some cars were actually loaded when the shippers suddenly discovered that they could not move their product in these new type cases, since such shipment would be in direct conflict with the federal law which forbids the use of any containers except those formally approved by the Interstate Commerce Commission. The shippers, therefore, took up the matter with the I.C.C. specialists and as soon as the necessary machinery could be set in motion a special order was issued permitting the use of the new containers on an experimental basis.

Fortunately the government men co-operated cordially to expedite this order, but pending its issuance in due form the shippers were embarrassed by having a large number of cases already loaded on freight cars awaiting movement. They had failed to take account of the fact that no matter how willing, neither the railroads, the Bureau of Explosives, nor the staff of the I.C.C. can permit even experimental use of a new container. The law is strict in this matter, explicitly requiring railroads to decline all shipments not packaged according to the formal orders of the Commission.

Under these circumstances those who desire to modify in any way the package or method of shipment of their commodities, if they be "explosives or other dangerous articles," should first consult with the I.C.C. staff and arrange definitely for the use of the modified package. They will thus save delay or embarrassment when they are actually ready to make shipments. Persons desiring such a change will doubtless find the Commission staff cordial in its co-operation and assistance; but they cannot expect these men to make informal adjustment for the convenience of the shipper, since such modifications are illegal.

Rubber Technologists Show Industrial Vision

PLANS for an international symposium on raw rubber to be held under the direction of John M. Bierer, chairman of the Rubber Section, American Chemical Society, are indicative of the leadership assumed by this live group of technologists.

Too often the technical sessions of scientific societies comprise a large proportion of disorganized rehash, the authors of which seem to appear merely as a matter of personal record and with nothing substantial to offer. Contrast such wasteful and colorless meetings with the purposeful efforts of the Rubber Section during the past year. The subject—raw rubber—is timely, and the contributors to the symposium will appear by invitation, according to a well-balanced program that will touch every significant phase of the subject.

Several specialists have even consented to journey overseas in order to speak. Scientific progress in the plantation industry; in wild rubber, South American and African; and in synthetic or artificial rubber, will be outlined. Rubber as a national asset, substitutes for rubber, the physical structure of rubber, the examination and testing of rubber, and the botany, chemistry and technology of guayule rubber will be some of the more specific topics that will receive attention. The economics of reclaimed rubber will be discussed also.

A program of this sort will not only advance the technology of the industry, but will help clarify a few somewhat confusing economic issues. Finally, it will bring closer together the technical man and the executive. The high example set by the Rubber Section at its February sessions in Akron and for the coming September meeting in Philadelphia could with benefit be followed by some of the less virile scientific bodies.

Relative Dust Hazards in Abrasives Industry

WITH the rapid expansion of the aluminum oxide and silicon carbide abrasives industry one would expect a corresponding increase in pulmonary diseases, as both the manufacture and use of synthetic grinding wheels expose the worker to a certain irreducible concentration of exceedingly hard, sharp and finely divided dust. However, extended clinical studies both in this country and in England show a remarkably small hazard, particularly as compared with that from the natural sandstone wheel.

From an examination of 58 workmen using machine-manufactured grinding wheels, Middleton, an English investigator, found that only 3 showed symptoms or physical signs of fibrosis. None had symptoms or signs of second- or third-degree fibrosis. On the other hand, of 269 wet sandstone operators, 217 had some form of

fibrosis. From this and other reports made by English investigators it is apparent that the inhalation of dust from the artificial grinding wheel is not as dangerous as from the natural sandstone wheel. Two reasons have been advanced in explanation:

1. An artificial grinding wheel of proper grain and grade will outwear at least 15 natural sandstones of the same size.

2. It is believed that the inhalation of silica is the primary cause of fibrosis, and the higher the proportion of free silica, the more rapid the progress of the disease.

Data cited by Drs. Clark and Simmons of the Norton Co., the workmen of which are continually under careful observation, definitely substantiate the conclusions reached in England. It is gratifying to find indications that the consumption of about 60,000,000 lb. of abrasive material, mainly in the form of grinding wheels, is not contributing to the already too formidable list of health hazards seemingly inseparable from modern industry.

Unfair Competition in Foreign Trade

WHAT in many ways is the most important case to come before the Tariff Commission since the passage of the Tariff Act of 1922 involves charges of unfair competition in the importation of a chemical engineering product. The petition of the Bakelite Corporation to make permanent the temporary embargo against imported synthetic resins marks the first attempt to use a means of defense previously overlooked by American industry.

Congress in framing Sec. 316 of Title III of the Act of 1922, followed the suggestion of the Tariff Commission and embodied a radically new provision to safeguard the American manufacturer from unfair methods of competition and unfair acts in the importation of foreign goods. This extended to the import trade practically the same prohibition against unfair competition as the Federal Trade Commission Act provided for interstate commerce. Such practices as counterfeiting and imitating goods, commercial bribery, concealed and open bounties, full-line forcing and false and misleading advertising thus came under a ban which provided the penalty of additional duties, or in extreme cases the absolute exclusion of the imported product. Investigations under this act are made by the Tariff Commission; and after its findings are reviewed on questions of law by the U. S. Court of Customs Appeals they are transmitted for executive action.

The present embargo was ordered by the President last April on the preliminary representation that the existence of the American industry was being threatened by the importation of low-priced imitations and their subsequent sale in such a manner as to take unfair advantage of the trademark, patents and good will of the domestic manufacturer. Formal hearings have been held at which both manufacturers and importers argued their cases. Final briefs were filed by each within the past fortnight and a decision by the Tariff Commission is shortly to be expected.

The outcome will be awaited with interest not alone because of the significance of the American chemical industry involved. The case may establish a precedent that will help to rid business of unfair practices and thus remedy the ills from which many other of our domestic industries are suffering.

New Factors in Potash Situation

CONCURRENT with attempts to uncover domestic supplies of potash, come reports that all is not well with the syndicate which controls the deposits in Germany and Alsace. For some time contrary views have been held by German producers relative to the method of marketing potash. In some quarters it was held that a lowering of prices to consumers would benefit the industry by creating a wider distribution. Advocates for a larger tonnage movement went so far as to seek control of the syndicate but were unsuccessful.

Of greater significance, however, is the report that differences exist between German and Alsatian factors. The question of export quotas appears to be the rock on which ultimately the syndicate may be shattered. Prior to the war, production of potash in Alsace was relatively small amounting to about 6 per cent of the total output of the syndicate. When these mines came under French jurisdiction, improvements were made which brought about a material increase in output and in 1924 sales of the Alsatian product represented 34 per cent of the distribution of the syndicate.

Under the present agreement export trade in potash is allocated on a basis of 70 per cent to Germany and 30 per cent to Alsace. As consumption of potash has not increased to an appreciable extent since 1913, it is apparent that the increase in export trade enjoyed by Alsace must work to the detriment of Germany. Furthermore, productive capacity of German mines is being increased by the introduction of modern equipment. Thus the question of finding a market for surplus stocks is becoming more acute. Will it lead to a price schedule adapted to stimulate consumption or will it give rise to a controversy over export quotas and spell the breaking up of the syndicate?

Progress in Conditioning Deliquescent Salts

PREPARATION of chemicals in a form best suited to resist caking and deliquescent action during periods of high humidity is an important matter, especially for such industrial materials as must be handled in bulk.

Manufacturers of concentrated fertilizer materials have found that the physical condition of the material is an exceedingly important factor in controlling caking. As a result the "graining" of these materials has been undertaken. One special form of graining has been developed independently by several investigators in this country and abroad. This process consists in atomizing the molten material or an extremely concentrated solution of the salt in such a way that the droplets of material harden in the air. The result is a spherule of the substance, the size of which depends upon the conditions of spraying and solidification of the drops. These spherules have a minimum surface per unit of weight for any given size of grain and are consequently most slowly affected by atmospheric conditions.

The technique of producing these spherules has been developed very successfully for two or three materials. Among the products so treated are certain of the concentrated fertilizer compounds such as urea, calcium nitrate with ammonium nitrate admixture, and perhaps some of the ammonium phosphates. The processes used are extremely simple and certainly should be readily adaptable to other industrial chemicals.

Institute of Chemical Engineers Holds Corrosion Symposium

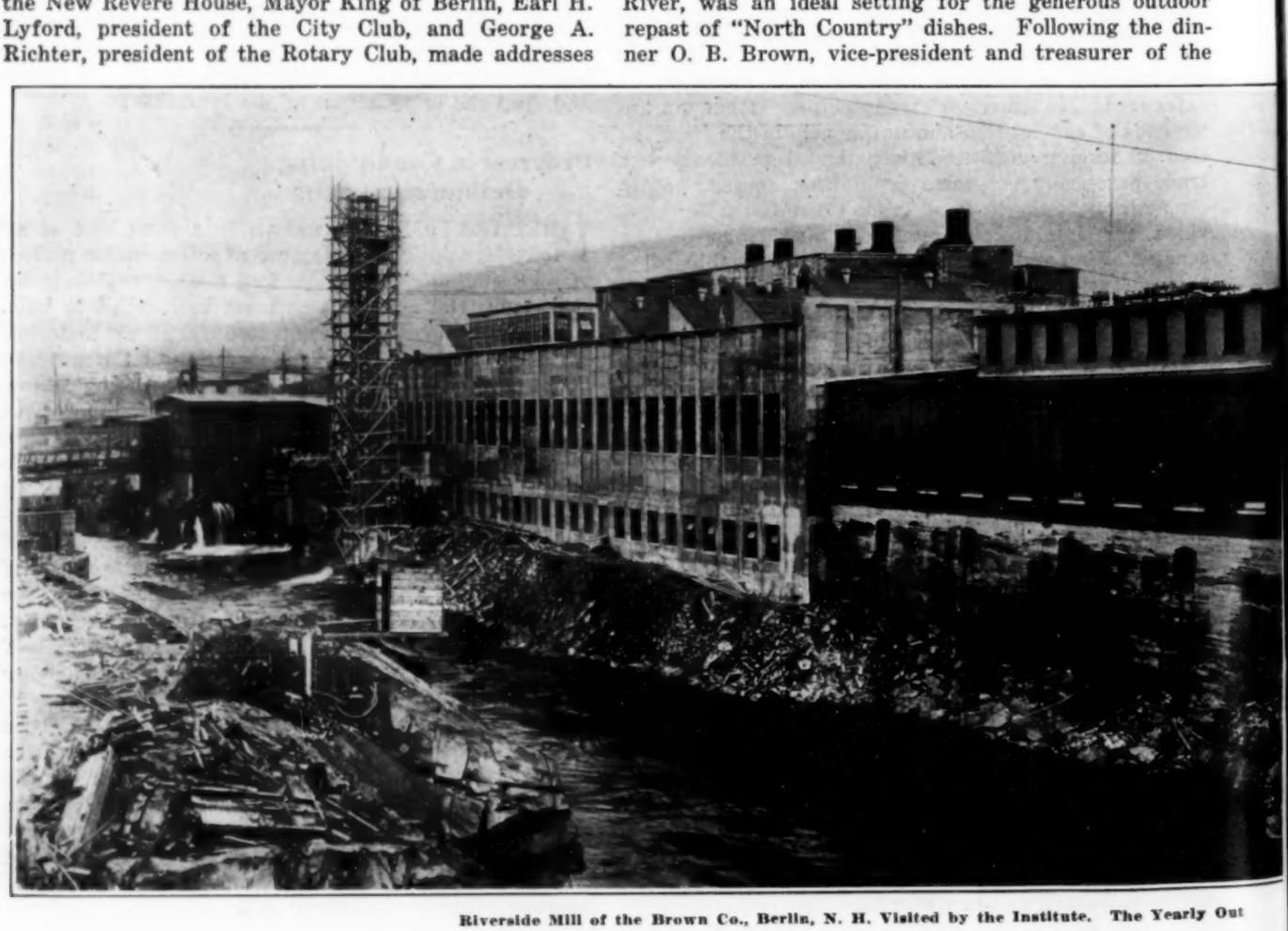
Resistance of stainless steels, corrosion of locomotive boilers and study of design with relation to severe service among principal topics of technical sessions convened in Berlin, N. H., June 21 to 24

Editorial Staff Report

NEARLY 200 members and visitors attended the 18th semi-annual meeting of the American Institute of Chemical Engineers which convened in Berlin and Gorham, N. H., from Monday, June 21 to Thursday the 24th. For the second time in eight years, the Institute enjoyed the hospitality of this center, which is so well known for its highly-developed paper industry and surpassing natural scenery. A large proportion of the gathering arrived by motor on the preceding Sunday, and as the weather was favorable most of the time, the ambitious program of technical sessions, plant visits and social functions was completed with an efficiency characteristic of well-ordered chemical engineering projects.

The technical sessions were held on Monday, Tuesday and Wednesday mornings, the Berlin City Hall being available for this purpose. At luncheon on Monday, at the New Revere House, Mayor King of Berlin, Earl H. Lyford, president of the City Club, and George A. Richter, president of the Rotary Club, made addresses of welcome to the Institute. On Monday afternoon the sawmill and sulphite pulp mill of the Brown Co., were inspected by more than 100 members who were impressed by the magnitude of operations, the skill displayed in mechanical handling of materials, and the extensive integration of the industry—ranging from forest culture to the making of finished paper, chemicals and the utilization of numerous byproducts. In the evening a most successful smoker was held at the Mt. Madison House, Gorham, the headquarters of the Institute. Due to the witticisms of two black-face comedians, the virtues—and also failings—of many prominent chemical engineers were dramatized to the edification and amusement of those assembled.

Tuesday marked the peak-load socially with a real lumberman's dinner and field sports as a novel feature. Milan, 15 miles north of Berlin on the Androscoggin River, was an ideal setting for the generous outdoor repast of "North Country" dishes. Following the dinner O. B. Brown, vice-president and treasurer of the



Riverside Mill of the Brown Co., Berlin, N. H. Visited by the Institute. The Yearly Out

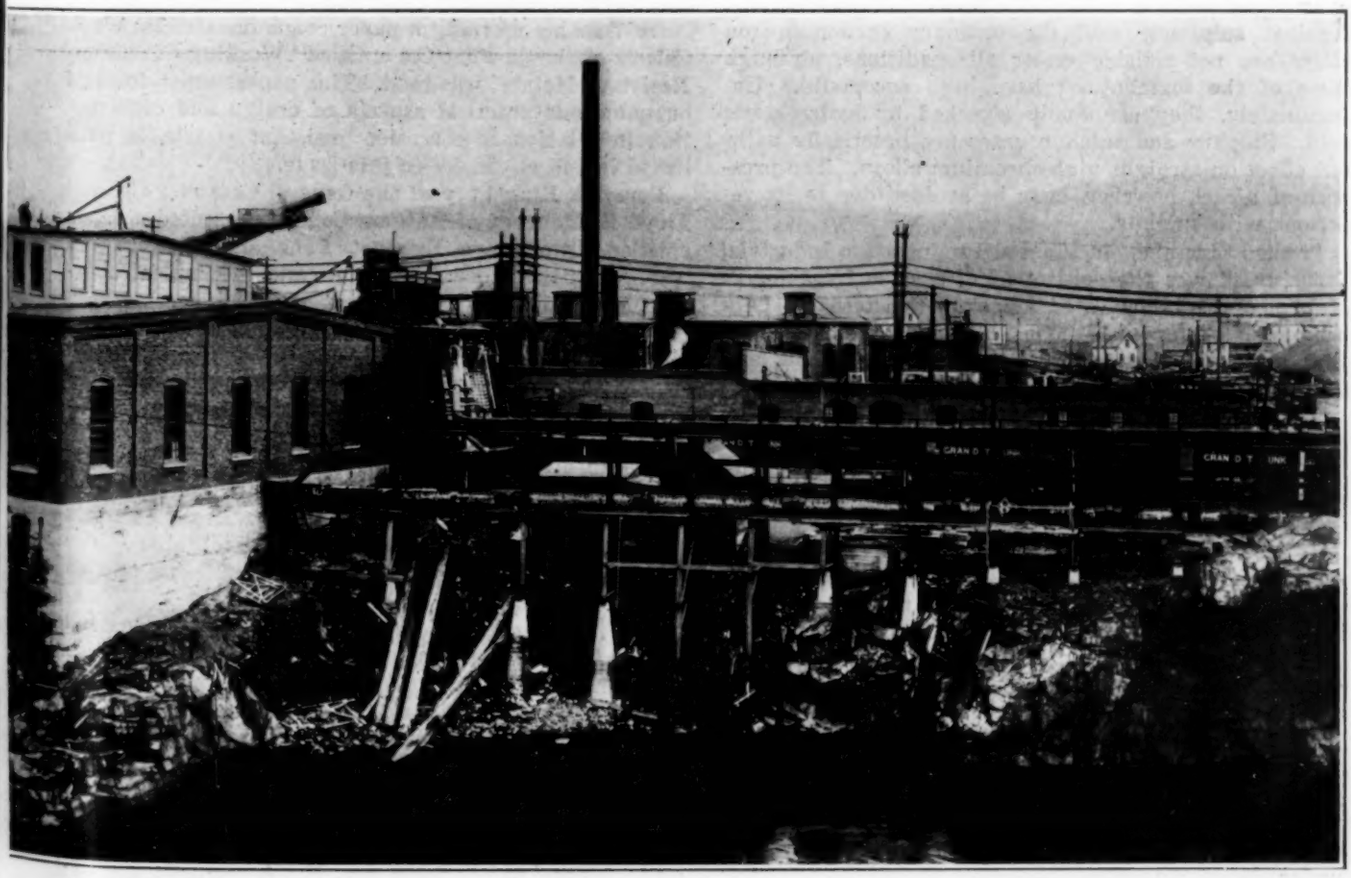
Brown Co. welcomed the visiting engineers and guests. His speech was most cordial and contained a generous appreciation of the chemical engineering profession. Woodsmen entertained with song and dance and President Moore made a brave attempt to sing "Alloutte," but the air pressure failed after the third bar. The remainder is promised for some later meeting. Tree cutting and water sports featuring the prowess of lumberman with axe, oar and pike, concluded the afternoon program. In the evening President and Mrs. Moore received at the Androscoggin Valley Country Club at Gorham, and the reception was followed by dancing.

Wednesday, following luncheon at the New Revere House, the fibre conduit mill and kraft paper mill of the Brown Co., were visited. Fibre cylinders developed during the War as containers for shells have been modified for peace-time uses, and the present product after forming on mandrels and drying, is impregnated with tar, the finished product finding wide use in electrical work. Gov. John G. Winant and Charles H. Herty, president of the Synthetic Organic Chemical Manufacturers' Association, spoke at a subscription dinner held in Berlin Wednesday evening. The formal program of the Institute was concluded on Thursday morning with a visit to the plant of the International Paper Co., Berlin, N. H.

On Monday and Tuesday mornings subjects in the corrosion symposium were presented. First on the program was an "Introductory Paper" by Paul D. Merica, of the International Nickel Co., who outlined the progress now being made in corrosion research. Present tendencies are against the so-called universal alloys the aim of which is to satisfy widely varying conditions of service. Instead, alloy types are being developed for specific purposes. This plan has yielded satisfactory results. A comparison program has been the study of standard methods of fabrication. The use of some methods necessarily is limited by the physical properties of the metal. Welding, casting, forging, rolling and drawing in particular have received attention. One of the definite advances has been for example, the welding of high chromium steels in the atomic hydrogen arc.

F. F. Chapman of the du Pont Co. gave a paper on "Corrosive Effect of Nitric Acid, Mixed Acid and Sulphuric Acid on Some of the New Alloys with Special Reference to Stainless Steels." This study was made to develop suitable equipment for plants manufacturing and reclaiming nitric and sulphuric acids.

Results of this work showed an excellent resistance of nearly all the chromium steels, that is the stainless steels of stainless irons to all strengths of nitric acid at all temperatures up to the boiling point. The author said that 50 per cent nitric acid at its boiling point indicates corrosion, but not enough to eliminate the use of stainless steel where a life of a few years would be considered satisfactory. Welded joints in chromium steel equipment are satisfactory if the correct technique of welding is mastered. In fact, laboratory tests on good welded joints showed nearly the same resistance to corrosion as did sheets of the same metal. Apparently the use of chromium steel of different compositions in the same line is permissible. Occasionally, failures have been obtained in plant practice when the two steels have been used in the same line. This is the exception rather than the rule, as in some instances as many as four different chromium steels have been used in the same line for six months without definite signs of corrosion. Another application of chromium steel is in equipment for strong mixed acids, against which they have excellent resistance.



put from this and Other Berlin Paper Mills Would Encircle the Globe 19 times, Assuming a Sheet 15 ft. Wide

"Corrosive Effect of Nitric and Hydrochloric Acid on Lead Containing Small Amounts of Copper and Antimony" was the subject of a paper by J. C. Olsen, M. H. Quell and Wm. G. Holly of the Brooklyn Polytechnic Institute. In general, pure lead was found to be more satisfactory than alloys containing small amounts of antimony or copper. This was due probably to the firmly adherent protective film that is formed on pure lead.

A companion to the discussion by F. F. Chapman was a paper by C. E. MacQuigg of the Union Carbide & Carbon Research Laboratories on "Chromium Alloys in Chemical Plant Apparatus." The author said that chromium imparts oxidation resistance to the ferrous alloys and this holds true for oxidation in general, either wet or dry and at low or high temperatures. The resistance of the element chromium and its alloys to chemical attack by electrolyte resides in the inertness of the product formed as a protective film. This theory confirms the well-established experience in industry, namely, that after a relatively light initial scaling, the metal is protected from further oxidation by a tough, dense and closely adherent enamel-like coating. When used alone, unless it is present in amounts upward of at least 10 or 15 per cent, a chromium alloy will not have the best chemical resistance. The oxidation resistant property of chromium is also imparted to its alloys against attack in the wet way, nitric acid being without effect if the metal contains about 12 per cent or more of chromium even in the absence of other alloying elements in appreciable amounts.

For resistance to wet attack in other than oxidizing media, no general rules can be formulated. Chromium and chrome-nickel have a remarkable versatility. Among the chemicals that are resisted are: Acetic acids, many hydroxides, fruit and vegetable juices and mine waters. Against sulphuric acid the ordinary chromium-iron alloys are not reliable under all conditions, although some of the installations have been successful. Unfortunately, they are easily attacked by hydrochloric acid. Sulphur and sulphur gases are practically without effect on straight high-chromium alloys. The presence of nickel, however, is to be avoided due to its reactions with sulphur.

"Rolled Zinc and Zinc-Coated Products for Industrial Structures" was the subject of discussion by John B. Hubbell and William H. Finkeldey of the Research Laboratory, New Jersey Zinc Co. The authors pointed out that atmospheric deterioration, uncomplicated by any unusual chemical conditions, is an almost universal corrosion problem, and in many industries in which chemical engineers are interested, it is predominant. For this type of service, zinc makes an excellent roofing material. The following precautions should, however, be observed:

1. Zinc, like copper, has a fairly high co-efficient of thermal expansion. Consequently it is necessary to design a roof with suitable expansion joints to prevent buckling.

2. Compared to steel, zinc has low tensile strength and consequently it should be supported adequately to obtain the best results. Recommended specifications for roof construction were given by the authors.

3. In laying zinc over a full-sheathed board roof, gypsum block or concrete, a layer of building paper of the moisture-proof type should first be placed on the roof, in order to prevent excessive condensation on the under side of the metal.

In a report entitled "Corrosion of Flues and Sheets in Locomotive Boilers," by William M. Barr and Robert W. Savidge of the Union Pacific System, the necessity of selecting boiler tubes of homogeneous material and free from segregated impurities was stressed. The old process of cold drawing of tubes unquestionably was the source of much corrosion and probably of embrittlement in strong alkaline solutions. In the cold process there is a chance that all of the tubes will not be uniformly annealed and under this condition, some tubes are more susceptible to corrosion than are others. It is now possible to obtain hot-rolled boiler tubes. In this process, the metal is worked hot and the resulting crystal structure of the metal is likely to be fairly uniform.

Another important preventive measure in the treatment of boiler corrosion is the removal of incrusting matter from the feed water, thereby preventing scale, increasing the life of flues and fireboxes and reducing fuel cost. Proper water treatment goes further than this in the removal of oxygen before the water enters the boiler and in the regulation of the concentration of dissolved solids. Present practice is to remove the incrusting solids and carry a slight excess of caustic soda because of its inhibitive effect on corrosion. Too great an excess of caustic soda or of sodium carbonate should be avoided, in order to prevent foaming, particularly in the presence of high concentration of dissolved solids. It is possible to carry an excess of 20 to 30 parts per million of caustic soda without interfering with the operation. This may be increased in some cases to 50 to 60 parts per million without fear of embrittlement from the action of the caustic steel. The general consensus of opinion is that the embrittlement is due to strained or dirty steel in contact with water of extra causticity. Laboratory experiments have confirmed this.

On Tuesday morning a paper communicated by W. S. Calcott of the du Pont Co. entitled "Working Corrosion-Resistant Metals" was read. This paper, which touched on numerous practical aspects of design and construction in relation to corrosion resistant metals, is published in full elsewhere in this issue.

Percy C. Kingsbury of the General Ceramics Co. and Floyd E. Mehrhof of Rutgers College presented a paper entitled "Stoneware Exhaust Fans and Blowers" in which was described the design and mechanical characteristics of modern equipment of this type.

John H. Graff of the research department of the Brown Co., discussed the "Analysis of Statistics" In which was demonstrated methods of interpreting economic and technical data for the benefit of plant executives and engineers. The data used were not of a chemical engineering character, but were drawn from material of general economic interest, such as security and commodity prices, building statistics, railroad earnings and other factors from Babson's statistical tables. The analytical method developed can, of course, be applied to any specific tabulation.

R. H. Heilman of the Mellon Institute for Industrial Research described "Apparatus for the Determination of Thermal Conductivity of High-Temperature Insulation," being the results of investigational work on the development of a flat-plate testing device for the accurate determination of the thermal conductivities of high-temperature heat installations and refractory materials. The apparatus developed is capable of measuring the thermal conductivity of materials at mean temperatures up to approximately 2,000 deg. F. A complete descrip-

tion of the apparatus was included together with experimental data showing the precision that can be expected with this type of testing equipment.

P. E. Landolt and N. W. Sultzer of the Western Precipitation Co., and the Research Corp., respectively, presented a paper on "Sulphur Dioxide Gas Cleaning for Sulphite Liquor Production from Pyrites." This paper was the outcome of extensive studies by pulp and paper manufacturers during the past year to determine the feasibility of using pyrites fines and concentrates instead of brimstone as the source of sulphur dioxide gas in the manufacture of sulphite liquor. The advantage lies in not only being able to use pyrites as the source of sulphur, in the event of high prices or difficulty in obtaining brimstone, but the equivalent cost of the sulphur in pyrites is less than its equivalent cost in brimstone.

In the method described, the sulphur dioxide gas from pyrites roastings is first passed through a spray tower thereby removing the greater portion of the solid suspended matter, and the cooled gas is then treated in a Cottrell electrical precipitation installation to remove the remaining portion of the suspended dust and such acid mist and other matter that may be present as a result of the roasting operation.

A design of the equipment in its present state of development was described, and it is said that such gas cleaning equipment should apply just as well to pulp and paper plants as to other operations in which the method has been a success.

The concluding paper of the technical sessions was "Hydrogen Ion Control in Paper Manufacture" by W. A. Taylor, of the La Motte Chemical Products Co. A rapid method for determining hydrogen-ion concentration through colorimetric comparison with standardized indicator solutions was described. The technique of the method is said to be extremely simple, and capable of a precision of $\frac{1}{10}$ of a pH unit in the hands of a non-technical workman or foreman.

Colloid Chemists Gather at Cambridge

Fourth national symposium held under auspices of the M. I. T. and Northeastern Section, A. C. S., is marked success

THAT chemists in this country are alive to modern developments in the science is clearly demonstrated by the fact that more than 200 attended the Fourth National Colloid Symposium held at the Massachusetts Institute of Technology, Cambridge, Mass., June 23 to 25 inclusive.

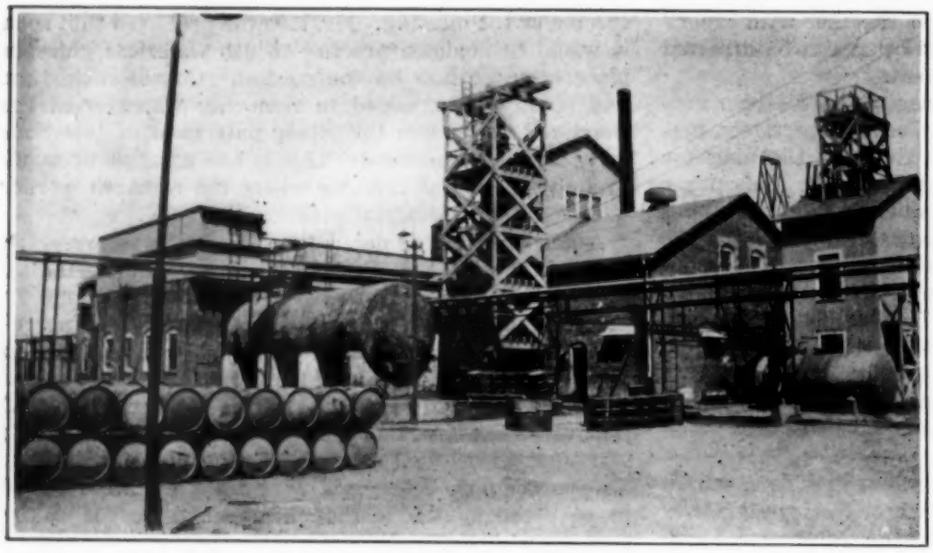
Altogether 23 papers were presented, many of them being of profound interest, not only to the worker in pure research but also to the industrialists. A timely note was sounded by the guest of honor, Prof. James W. McBain of the University of Bristol, when he plead for emphasis on results actually obtained by experiment. Too often, results of real value are obscured by faulty theorizing in connection with publication.

It would be difficult to single out any one outstanding paper from the meeting as there were many of unusual merit. Mention can be made of a few that have direct application to industrial problems. The paper by F. L. Browne and T. R. Truax on "The Place of Adhesion in the Gluing of Wood" around the most interesting discussion of the meeting. Mr. Browne predicted that soon it would be common practice to use waterless glues in place of those now on the market. Considerable time and energy is expended in removing water from the wood and at present the joiner puts most of this back when he glues the wood. This is one example of many brought out at the meeting where the research worker is able to aid industrial practice.

A new test for the detergency of soaps was presented by T. R. Briggs and F. H. Rhodes in "The De-Inking of Paper." The method used consists essentially in agitating a weighed sample of newspaper with the reagent under test, washing it, and submitting the pulp to a color-matching device. The amount of ink removed is measured by the whiteness of the resultant pulp and removal is expressed as the fraction whiteness of pulp; whiteness of original paper before any ink was applied. All the common detergents were used and were found to be rated by the method in the same order as by laundry practice.

Two papers on emulsions were presented. The first of these was by W. P. Davey on the manufacture of japan emulsions. The speaker gave word pictures of his conception of emulsions and of the manner of their stabilization. He outlined a method which has been in satisfactory operation for a number of years for the preparation of japanning emulsions. This consists essentially of slow agitation of water with a japan containing soap in solution. To break the emulsion, a hot piece of metal is plunged into it, thus precipitating a film of japan on the metal. The second emulsion paper was by Brian Mead, on "Emulsfication: A Study of Oil Soluble Emulsifying Agents," and dealt with the principles underlying the breaking of crude-oil emulsions. Details were given of the use of oleic and stearic acids as breaking agents for such emulsions, and also of their effect on the oil-water interfacial tension, as revealed by the stalagmometer.

Another pair of papers may well bring to a close this necessarily brief survey of the meetings. An instructive paper by W. H. Dore and O. L. Sponster on "The Structure of Ramie Cellulose as Derived from X-ray Data" gave a most encouraging example of the possibilities of this newest tool of the chemist to the elucidation of the structure of materials. A model was made by the authors and shown by Professor McBain, who read the paper, showing the actual structure of the cellulose molecules. Moreover, evidence was given showing how the structure changed on hydration, and altogether affording a satisfactory explanation of the physical and chemical changes that cellulose may undergo. G. L. Clark, in "X-rays and Colloids" gave the results of an important series of investigations on colloidal materials. Normally one considers rubber as being about as typical a non-crystalline material as can be imagined, and yet X-ray photographs show it to be crystalline or at least to contain crystalline material. Analysis of the data shows that the maximum number of C_5H_8 groups in the unit cell for rubber is 6, for balata also 6 and for gutta percha 12. An interesting example of a gradual transition from collodial to crystalline is afforded by gas black, which on successive heating, shows a perfectly continuous transformation into the crystalline graphite. As Professor McBain commented, "the day is fast approaching when every research laboratory must have its X-ray outfit, together, with men capable of interpreting the data obtained thereby."



Plant for the Production of Secondary Alcohols

Located at Okmulgee, Oklahoma, at the Empire Refineries, Inc., this plant uses as its raw material the unsaturated hydrocarbons obtained in the cracking of petroleum distillates. These constituents are scrubbed from the gases by countercurrent treatment with sulphuric acid in the tower shown in the center of this picture. The alkyl acid esters formed are hydrolized in the building at the right to produce the alcohols and free the acid.

The airplane photograph at the bottom of this page shows the relation of the alcohol plant to the cracking stills and other equipment at the Empire refinery.

Commercial Production of Isopropyl Alcohol

Olefine hydrocarbons from petroleum furnish basis of new and diversified chemical industry

By S. D. Kirkpatrick
Associate Editor, *Chem. & Met.*

CONVINCING evidence of the progress being made in the utilization of petroleum as a raw material for chemical industry is to be found in the plant of the Empire Refineries, Inc., at Okmulgee, Oklahoma. Here, on a commercial scale, are to be seen the results of a laboratory research begun in January, 1918, and carried forward by the Doherty Research Company through the various stages that have led to its present state of development—i.e., the commercial manufacture of isopropyl, secondary butyl and other secondary alcohols from the olefine hydrocarbons that result from the cracking of petroleum distillates. This alcohol plant, one of three in the United States, is second in size to that of the Standard Oil Company (New Jersey) who entered this field with the purchase of certain basic patents in 1919 and who subsequently carried on development work of a similar character to that of the Doherty organization. The Standard company first placed the manufacturing of isopropyl and higher alcohols on a commercial basis and the Doherty organization entered the field independently sometime later as a result of its own research.

The raw material of the Okmulgee plant is the gas produced in the cracking stills of the neighboring Empire refinery. Of the considerable quantity of gas that is available only a small portion is now used in the alcohol plant. The olefine hydrocarbons making up a small percentage of the gas is the source of all the alcohols, the gas being treated with sulphuric acid, by the well-known reaction wherein the olefines combine with the acid to form alkyl acid esters which are hydrolized to produce the alcohol and free the acid. If the temperature of the acid is sufficiently high, ethylene will react to form ethyl alcohol but since for various reasons this product is not desired, a low reaction temperature between the acid and the hydrocarbons is carefully maintained and as result the ethylene passes through the process and is discharged with the exit gases. However, the principal reason for maintaining a low temperature is that the low temperature is most suitable for the major reaction and at this temperature ethylene does not react with the acid.

The gas from the cracking stills, properly purified in case it is necessary to remove sulphur compounds, is compressed and is passed into the bottom of an absorbing tower. The moisture and liquid condensed as a result of the compression are separated and the condensed

Will Petroleum Rival Coal Tar as a Raw Material for Chemical Industry?

"We are producers of vast quantities of petroleum products. We have an opportunity to develop great chemical industries based on abundant raw material yet we use this possible source of untold riches only to move us from place to place. I believe petroleum offers the same amazing possibilities as did coal tar. I am not suggesting that anyone try to make a fortune from petroleum, but that the many scientific problems pushing forward for study be approached in the same spirit that finally led to the triumphs attained in aromatic chemistry."

Dr. James F. Norris

olefines are also introduced into the absorbing tower. Here the gases come in contact with the sulphuric acid which enters the top of the tower and as it falls to the bottom gradually becomes saturated with the hydrocarbons. The temperature within the tower is controlled by the circulation of brine through cooling coils. If the temperature and the rate of reaction have been properly controlled, the acid will have removed practically all of the olefines (except ethylene) from the compressed exit gas which is piped to other parts of the plant to be burned under boilers or stills or utilized in other ways.

The remainder of the process of manufacturing alcohol is covered by patents under which the Standard Oil Company (New Jersey) and the Doherty organization are licensees. Neither of them is willing to have published the details of the process as actually used, further than shown in published patents on the subject, as such publications may lead to infringement of their patent rights.

The finished isopropyl and secondary butyl alcohols are made by a redistillation using especially efficient fractionation and purification by treating in various ways. These produce the highest quality product which the market requires.

From Test Tube to Tank Car

These secondary alcohols from petroleum, which ten years ago were rare curiosities found only in a few organic chemical laboratories, have since become available in tank car lots and are finding useful application in many industries. The most important of the alcohols from the viewpoint of quantity available is isopropyl alcohol, $CH_3CH(OH)CH_3$ which is sold under the trade name of Petrohol, having the following properties as compared with secondary butyl: $CH_3CHOHCH_2CH_3$ and secondary amyl $C_5H_{11}CH(OH)CH$:

Chemical and Physical Properties of Alcohols from Petroleum

	Isopropyl	Sec. Butyl	Sec. Amyl
Boiling point at 760 mm	82.4 deg. C.	99.5 deg. C.	119.0 deg. C.
Specific gravity 20/4	.7855	.8063	.8088
Constant boiling mixture with water			
Boiling point	80.4 deg. C.	87.5 deg. C.	Steam distills at 92 deg. C.
Specific gravity 20/4	.816	.862	
Alcohol by volume	90.7 per cent	77.7 per cent	
Solubility in water	Infinite	Partial 21.5 per cent solution	Partial about 4 per cent solution

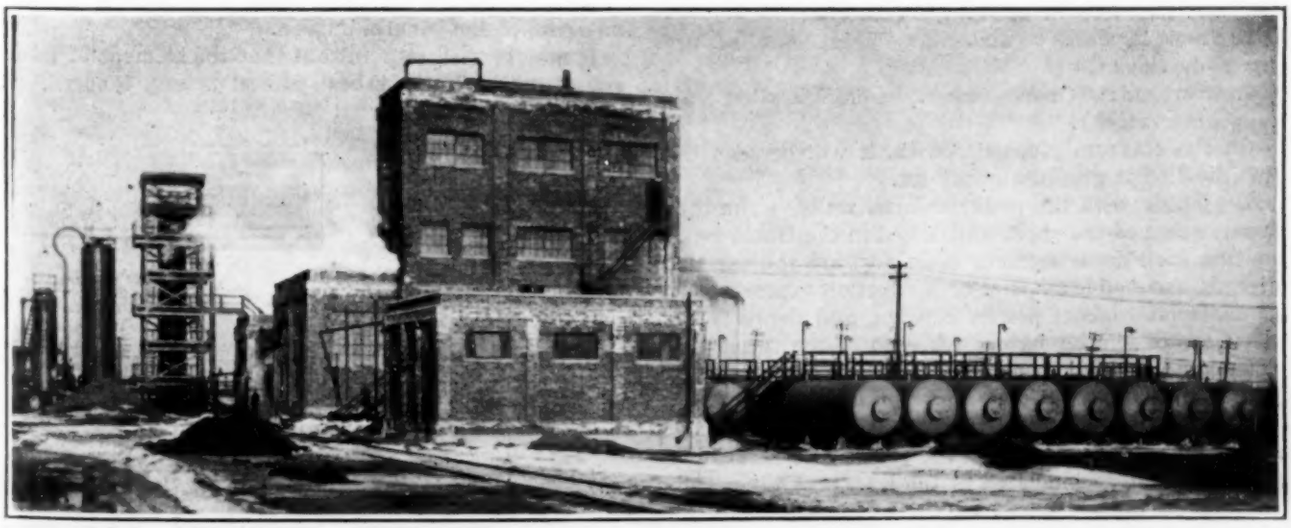
Petrohol is of a clean and sweet odor and the color is clear both before and after dilution with water. The odors of secondary butyl and secondary amyl are clean, secondary butyl is colorless and clear and secondary amyl is not usually darker than pale yellow.

Probably the most important of the present and potential industrial uses of these alcohols will be as solvents and as raw materials for organic chemical syntheses. The rapid growth of both the pyroxylin lacquer and rayon industries has greatly increased the demand for volatile solvents and has encouraged the production of many new derivatives. A number of interesting compounds, such as isopropyl chloride, secondary butyl chloride and secondary amyl chloride, have already been synthesized from the higher alcohols obtained from petroleum. Further research is under way in many laboratories and other industrial applications are to be expected.

The antiseptic and pharmacological properties of isopropyl alcohol have also been studied and have led to the use of the product as a surgical antiseptic. It appears to have about twice the germicidal power of ethyl alcohol and yet has no markedly different effect on the skin. When injected intravenously it is more toxic than ethyl alcohol although its vapors are even less injurious. Small quantities taken internally have shown no harmful effects except to cause temporary depression.

The higher alcohols, secondary hexyl, heptyl, octyl, nonyl, and decyl, which are the more valuable from a commercial point of view but present in smaller quantities, in the gases, will soon be obtained commercially and their production will doubtless be considerably expanded in the future, although they are not expected to be available for several months or perhaps a year. Tank car lots of petrohol are now being sold by the Standard Oil Company (New Jersey).

While the preceding description is incomplete and the reactions involved are apparently comparatively simple, it will be appreciated that a great deal of pioneering development work was necessary to put the process on its present commercial basis. The progress thus made is a tribute to chemical engineering and augurs well for a much greater development in which petroleum may be expected to furnish the basis for a new and extremely diversified chemical industry.



Largest of the Present Production Units for Which Petroleum Hydrocarbons Supply the Principal Raw Material
Isopropyl alcohol plant of the Standard Oil Company of New Jersey at Bayway, N. J.

Technical and Economic Advances in Fertilizer Industry

Uniform cost accounting system, plant management, progress in sulphuric acid technology and general aspects of air-nitrogen industry are leading topics of current interest

EDITOR'S NOTE—The first annual convention of the new National Fertilizer Association convened at White Sulphur Springs, W. Va., June 7-10, was marked by a lively interest in the leading technological and economic aspects of the industry. As was promised in our June issue, four of the papers that have broad significance to chemical engineers are published herewith in the form of signed abstracts. It is felt that the fertilizer industry should be congratulated on the scope and excellence of the technical program, which, it is hoped, will be maintained at the present high standards.

Fertilizer Production Costs

A résumé by the Chairman of the Cost Accounting Committee of the National Fertilizer Association

By B. A. McKinney
Auditor, The F. S. Royster Guano Co., Norfolk, Va.

TO anyone who studies the subject of costs and production it will become clearer and clearer that the production of acid phosphate is the vital element in the fertilizer industry. It will also become apparent that a proper apprehension of the cost of producing this element is absolutely essential, if the industry is ever to operate on a sane and logical basis.

To the owner, or any practical man, who looks for his income to the sale of his products, the elements of cost of any product are as follows:

1. Production.
2. Management.
3. Administration.
4. Marketing.

If we translate these terms into accounting terms we find that they may be reduced to two, viz.:

1. Plant expense: (materials, labor, etc., of production);
2. Overhead: (management, administration and marketing).

On the diagram given herewith, it will be seen that this division is graphically set out.

Beginning with the plant expense, we have the three departments of the plant, and, noted in the frame representing each department of the plant, are the expenses directly assignable as plant or production expenses, such as materials, labor, power, repairs, and depreciation; these are of similar nature for each of the three products, and are the absolutely necessary, or direct, expenses of the production.

But, before the cost of product is complete, we have shown above the diagram of the plant, the overhead expenses, which, as indicated by the lines, are a burden on the simple factory costs, and it is the allocating and placing of this burden properly of this overhead, so that it may fall correctly on the three products, that represents the principal problem in the cost accounting for fertilizers.

Taking up these burdens, we have the factory office, which represents the superintendent and factory office force and the laboratory, the timekeeper, watchman and a charge for taxes and insurance. This class of expenses, known as factory management, bear upon the three departments in a proportion, and in a manner which we have been careful to point out. It will be seen that the burden lines indicate that this class of expenses falls upon the three producing departments, and, consequently, becomes a part of the manufactured cost of each of the three products.

We next have the sales office, or marketing expense, consisting of the sales manager, salesmen, advertising and other expenses of distribution. We have pointed out that in the fertilizer industry this expense is incurred almost entirely for the purpose of selling mixed fertilizers (milled and bagged acid phosphate being treated as a mixed fertilizer); and, in the diagram, it will be seen that the burden line is shown as indicating that the weight of this charge, or overhead, should fall on the product of the dry mixing department.

We have left the general office, or administrative expenses, which include the officials, accounting forces, treasurer's expenses and interest on investment or capital expense. A little thought will show that this burden falls not only on the three departments of the factory, but partially on the sales office. The principal thought here is that it has been the custom heretofore to largely ignore the general office expenses as part of the production costs, with the result that the products, especially sulphuric acid and acid phosphate, so far as their cost figures are concerned, very largely escaped any part of the general burden.

It may be well to point out that the element of interest on investment has been almost utterly ignored. If

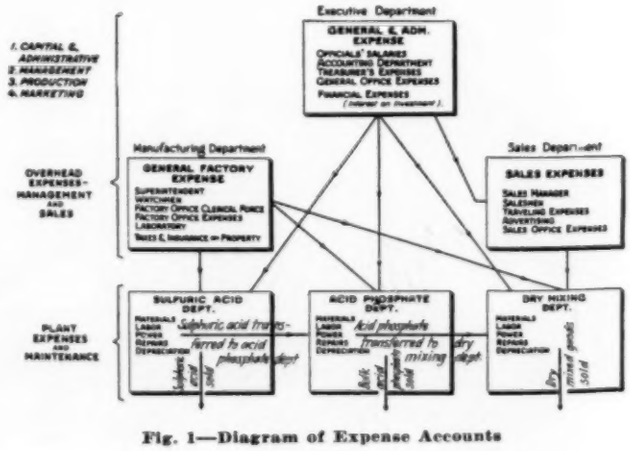


Fig. 1—Diagram of Expense Accounts

it will be borne in mind that the investment in the sulphuric acid and acid phosphate departments represents by far the greater part of the investment of a company, it will be seen that a fearful mistake is made in not burdening these products with any portion of the carrying charge of the investment. I think it may be truly said that the practice heretofore has largely been as if the frame of expenses representing management, and the frame of expenses representing general office and capital, had been moved over to the right and placed directly above the sales office expenses in the diagram, so that the whole burden bore directly upon the dry mixing department frame.

Now, if we were to consider that these outlets, shown at the bottom of each department frame, were openings, out of which the product poured (representing sales) it will be easily seen that the difference in pressure or cost burden would be on the product pouring out under the plan herewith given, and under the plan just described of placing the management and administrative frames directly above sales office frame.

Of course, the problem has its complications aside from this simple diagram. We have tried to set out, and explain very fully, and simply, the departmental relationships, looking towards the proper placing of these burdens. A system has been constructed that can be kept with a simple day book, journal and ledger, if it is not desired to use anything else. We recognize what is vitally needed is a proper apprehension of the elements of costs of each of these products, and a plan of securing these costs without undue amount of elaboration. We think we have met these conditions, and it is my heartfelt hope that steps may be taken whereby they may be used and applied.

Fertilizer Plant Economics

Comparison of fireproof mechanical handling and wooden plants shows little in favor of former type

By F. S. Lodge
Director, Manufacturing Department, Armour Fertilizer Works

THE building of fertilizer plants seems to have become somewhat of a habit. The industry has been like a flock of sheep—where one went, all followed. Territorial over-production is the result. Every manufacturer should cause a careful survey to be made of the territory surrounding a proposed new location. The present as well as the potential consumption within reasonable freights should be carefully estimated.

Existing dry-mixing plants should canvass present local producers carefully before expanding into acid phosphate production. The successful operation of an acid phosphate plant requires careful supervision of trained technical men. Consumers are too exacting to permit of an inferior product. The investment is large and the profits small. It is an operation wherein large tonnages are a requirement for low costs. Again I say, it is not sound economics to increase production or facilities when the article in question is already being manufactured beyond consumption, and with additional potential capacity also in existence.

There is no defense for a 7-1-1 with its low-grade, low-analysis materials and its ordinarily bountiful supply of filler. Had the industry used the normal high-grade high-analysis materials available to formulate goods of such high analysis that the consumer would not have to pay double manufacturing, bagging and freight costs nor unnecessary freights on excess quantities of useless filler, it would not now have been so much on the defensive. The future holds no brief for low-analysis goods. 12-4-4 is already looked on as standard rather than high grade. 15-5-5 and 18-6-6 are already sold in quantities.

In an effort to somewhat offset the increasing cost of labor, as well as to meet the shortage of labor that exists or did exist in certain sections, the mechanical handling or crane type of factory was designed. It undoubtedly did meet the necessity in the latter crisis, but it is doubtful in the former case. When interest and depreciation are figured on the increased capital invested; when power and repairs are taken into account, they will be found about to balance the labor and insurance credits.

One other justification of the mechanical type factory is the facility for intensive shipment. The shipping season is much shorter than formerly, and a plant must be prepared to handle the major portion of the business in a period of ten weeks. It would seem that the steel crane-type plant will probably be most justified in locations of high and scarce labor, and especially in plants of two shipping seasons when double tonnage can react on overhead.

As a matter of comparison, a two-season fireproof steel and concrete plant with property and appurtenances, including acid and acidulating departments, and built with crane installation, capable of shipping 100,000 tons per annum, is estimated to cost today approximately $1,100,000. Under the same conditions a wooden frame type of building of the same capacity is estimated to cost approximately $700,000. In the case of the crane plant at its maximum output, a capital expenditure of $11 per ton of output is estimated as against $7 for the wooden type—a difference of $4 per ton or figuring 12 per cent depreciation and interest, 48 cents per ton of output. This is just about the labor and insurance saving of the crane plant, power differential being classed as labor. But in a bad season, if the plants only ship half capacity, this capital investment jumps to $22 and $14 respectively—$8 per ton difference, or an overhead difference per ton of 98 cents with no change in the operating differential.

However, the mortality of the wooden constructed fertilizer plants has been extremely high. Insurance statisticians state that paid losses have far exceeded collected premiums the past few years. The industry is facing increased insurance rates and is criticized for its lack of housekeeping from a fire risk standpoint. Rates are general. The carelessness of one factory reflects on all. In order to reduce fire loss and in consequence insurance rates, every precaution should be taken in the plant. Frequent fire drills should be held. Careful periodical inspection of wiring, machinery and points of danger should be made. Fire-fighting equipment should be kept up to standard. These points being taken care of will better the fire record, and lower rates can be secured on this evidence.

From an engineering viewpoint no type of plant has yet been designed to solve satisfactorily that curse of the factory—multiplicity of brands. It is estimated that 2 per cent of a mill's daily capacity is lost for every

analysis change, provided a proper cutoff is secured. A factory shipping under such sales policies as appear to exist may easily lose 30 per cent of its possible capacity. Labor is paid by the hour and is standing still; the mill is running empty and power is being consumed; overhead is piling up, tonnage is not. Fewer brands permit better mechanical condition, more nearly correct analyses, more mechanical handling, consequently cheaper labor costs. This question has been agitated for several years. There has been much talk of the reduction in the number of brands. Inspection of the reports of the state control officials shows little, if any, improvement.

Progress in Sulphuric Acid Manufacture

Outstanding development of the past forty years in relation to the production of acid phosphate fertilizer

By P. C. Hoffman

General Manager, Manufacturing Department of the Virginia-Carolina Chemical Corporation

SOME TIME ago a statement was made to the effect that practically no improvements had been accomplished in the manufacturing methods of the fertilizer industry during the past 50 years. It would take too much time to cover the field as a whole, but I thought it might prove of interest to relate some of my personal experience in sulphuric acid manufacture during the past forty years, and outline briefly various economies and improvements that have been effected in that most important constituent of fertilizer manufacture.

During the early part of 1886, while engaged in analytical control work for a fertilizer plant, I was called upon to supervise the operation of a sulphuric acid plant, which had recently been equipped with Glover and Gay-Lussac towers. It was a comparatively easy task to bring about a decided improvement in yield and nitre consumption as no attempt had previously been made at this factory to control operations by means of systematic gas analyses.

At that time quite a number of plants were still operating as plain chambers and most of the sulphuric acid was produced from imported brimstone. A few years later pyrites came into general use. The method of burning lump pyrites remains practically unchanged to-day, and while capable of excellent results, is depending on skilled labor for successful operation. On the other hand, the method of burning fines-pyrites has been greatly improved. The mechanical Spence furnace constituted the first step in advance. It was, however, expensive to build and repairs were excessive. In the course of 5 years experience with this particular type of furnace, it was finally perfected so as to give fairly economical results. It could not, however, compete with the rotary type of furnace, first developed by McDougall Bros., and later on re-designed and put on a practical working basis by Herreshoff. In the course of time, this type of furnace has been further improved, so that today it is almost as simple to operate as a sulphur burner and is not dependent on skilled labor for efficient results.

The productive capacity of an acid plant depends to a large extent on the absorbing capacity of the Gay-Lussac towers. In other words, the higher the percentage of nitrogen that can be held in the system without loss through the exit, the higher the production of sulphuric acid per cubic foot of chamber space. Whereas plain chambers formerly required about 30 cu.ft. of chamber space per pound of sulphur burned, with the advent of Glover and Gay-Lussac towers this requirement was readily reduced to 20 cu.ft. Increased Gay-Lussac capacity permitted a still further reduction and about 30 years ago a plant operating on 15 cu.ft. chamber space was considered as doing good work.

About that time, while making extensive repairs to a certain plant, it was decided to increase its capacity. The problem involved consisted of doing so without increasing the size of existing buildings. Preliminary experiments had been made with water cooling. While this proved beneficial, it soon developed that the water supply available was entirely inadequate. We finally designed an apparatus, which became known as an "intensifier." Its purpose was to intensify reactions by thoroughly mixing and cooling the chamber gases. It was built of lead supported by suitable frame work and located between chambers. Over-all dimensions corresponded to cross section dimensions of chambers, being usually about 20 ft. high, 25 ft. long (equal to width of chamber) and 5 ft. wide. Top and bottom each consisted of a rectangular compartment about 3 x 4 x 25 ft. Between these compartments were located, at about 21 in. vertical distance apart, four smaller compartments 15 in. deep, 4 ft. wide and 25 ft. long. These various compartments were water-cooled and were intraconnected by means of a large number of vertical 3-in. or 4-in. lead pipes in staggered rows at sufficient distance apart to permit easy access. Results obtained proved satisfactory and in subsequent years over 50 of these intensifiers were installed at various plants. Thus for example, a certain plant built 25 years ago, burning lump pyrites, consisted of eight chambers containing 250,000 cu.ft. and eight intensifiers. It produced 60 tons 50 deg. per day, equivalent to 10 cu.ft. chamber space per pound of sulphur burned, yielding 4.78 lb. 50 deg. acid with a consumption of 3.5 per cent nitrate of soda. This represents average results obtained for a period of 12 years continuous operation. With the advent of the water spray system, incidental changes in chamber construction and other improvements, the intensifier, however, had outlived its usefulness, as it no longer proved economical from a cost of construction standpoint.

Lunge in his first edition mentioned the possibility of spraying water into the chambers in lieu of steam, describing a combination steam and water spray. We operated several of these sprays as far back as 1887 and continued experiments along that line during subsequent years. The idea, of course, was to eventually dispense with the use of steam. This required a spray capable of atomizing water in relatively small quantities. We finally devised a combination lead and platinum spray, atomizing about 4 gal. of water per hour, and which operates for long periods with a minimum of attention. We did not find opportunity, however, to equip a plant entirely with water sprays until 1905. This first attempt proved a complete success from the start and resulted in a net saving of 100 lb. of coal per ton 50 deg. acid produced. In consequence we equipped all of our plants in this manner within a few years.

At the same time fans were installed as draught pro-

ducers in place of the usual steam jet in exit flue. At points where cheap electric power was available, this enabled us to dispense with steam entirely. At other points, where we had to produce our own power, we effected certain other economies, so that finally we reduced coal requirements to 50 lb. of coal per ton of 50 deg. acid produced. Our best record today is at a plant producing sulphuric acid only, where, with a capacity of 150 tons 50 deg. acid per day, coal consumption for entire power requirements has not exceeded 40 lb. Alabama run-of-mine coal per ton of acid produced, for several years past.

Improvements in Nitre-Potting

One of the meanest operations in an acid plant is the "potting" of nitre and the resulting by-product "nitre cake" frequently constitutes a nuisance. We therefore developed a method whereby a solution of nitrate of soda was sprayed into the first chamber. This worked out very well, but it did increase wear on the sprays. As a final development we adopted the use of an intermediate tower located between Glover and first chamber. At that point temperatures are sufficiently high to obtain perfect denitration. The solution is run over this tower in a continuous stream. The tower itself is an excellent acid maker and the acid produced is kept separate and usually flows direct to mill tank. Many years experience has demonstrated the fact that the very small amount of soda in this acid does not affect results obtained in the manufacture of acid phosphate.

With the adoption of the water-spray system, the desirability of higher chambers soon became evident. In consequence chambers we have built during the past 15 years have a minimum height of 30 ft. We consider a height of 38 ft. as representing the most economical type of construction under average conditions.

The successful operation of an acid plant depends in a large measure on the respective efficiency of the Glover and Gay-Lussac towers. This efficiency is on the other hand dependent almost entirely on the method of packing. In the old days it was a universal custom to pack these towers with quartz and coke respectively. If properly packed, fairly good results were obtainable. There was always, however, a certain amount of inherent guess work and frequently two towers packed with utmost care and operating under identical conditions gave entirely different results. Hence we adopted the use of vitrified brick of suitable dimensions many years ago. The use of this material permits the design of a tower with mathematical certainty, and while the cost of this type of packing figures higher than either quartz or coke, this increased cost is more than offset by the fact that a brick packed tower for a given productive capacity can be made of smaller dimensions.

Among minor developments, we might mention the acid lift, which was first put on a practical working basis by Hughes and Lowndes, about 25 years ago. At our larger plants the use of this system for pumping acid enabled us to eliminate one man per shift. In the course of time these lifts have been perfected so that we can count on continuous operation for at least 5 years and without requiring any repairs whatsoever, during that period.

Modern Chamber Plants Nearly Automatic

In designing a modern sulphuric acid plant it is, of course, important to keep cost of construction down to the lowest possible minimum consistent with durability. Of equal importance, however, are its operating qualities. Our aim is to have a plant work almost automatically or with a minimum amount of attention. Hence we usually provide from 7 to 8 cu.ft. of chamber space per pound of sulphur burned. After such a plant has been put on a proper working basis, it is nothing unusual for it to continue to operate for weeks at a time without requiring any further regulation. This in turn has enabled us to reduce labor requirements materially. The operation of an average size plant requires only one man per 12-hour shift, 7 days per week and a helper in day time, 10 hours per day, 6 days per week, or a total of 3 men. A plant of this character operating on between 7 and 8 cu.ft. chamber space will consume not over 2.5 per cent nitre with a yield of 4.85 lb. 50 deg. acid per pound of sulphur burned. Future plant operation will probably be controlled from a central station by means of recording instruments such as thermometers, hydrometers, oxygen test, etc., thus reducing labor requirements to an absolute minimum.

Aside from the various improvements previously mentioned there have been quite a number of other developments during the past 40 years, the object of most of them being to reduce chamber space. Thus Lunge's plate column, for example, represents a most efficient apparatus. Unfortunately, however, cost of installation figures as a rule too high. This same objection applies to practically all similar devices. In other words, the same investment applied to additional chamber space will accomplish usually the same result. Several types of "tower" plants dispensing with chambers entirely have also been developed. The most noteworthy of these is probably the tower system developed by Opl in Austria about 17 years ago. In locations where cost of lead figures high, and acid-proof brick or similar material can be obtained cheaply, it is possible that this type of plant can be built to good advantage. Among more recent developments might be mentioned the Packard water-cooled chamber. Its general type of construction is in line with the English practice of dispensing with the usual chamber building entirely. This feature is, of course, only feasible in a moderate climate, where snow and ice do not have to be considered. Another important requisite is an adequate water supply and the cost of pumping relatively large quantities of water continuously has to be reckoned with. On the whole, even if such a plant can be built at reduced cost, this is probably more than offset by the higher degree of skill required to operate such a plant successfully.

Increased Efficiency Has Lowered Costs

In conclusion I might state that relative cost of sulphuric acid produced today figures just about $1 per ton less than it did 30 years ago, assuming cost of labor and materials as being the same, and including 6 per cent interest on investment. This is accounted for by the fact that yield has been increased from an average of 4.65 to 4.85, nitre consumption has been decreased from an average of 4.75 per cent to 2.50 per cent, and coal consumption reduced from 200 lb. to 50 lb. per ton 50 deg. acid produced. Aside from this, better construction and improved operating methods have resulted in a reduction in the item of repairs fully 20c. per ton. Finally the complete capital cost of a sulphuric acid plant today figures at least 20 per cent less, assuming identical cost for labor and materials.

It would thus appear that on basis of present day results the margin available for further cost reduction is nearly at a minimum. The greatest opportunity would seem to consist of further possible improvement in construction cost, thus reducing interest charge per ton of output.

The Air-Nitrogen Industry At Home and Abroad

Recent developments and those on the immediate horizon hold promising technical and economic possibilities

By Harry A. Curtis
Professor of Chemical Engineering, Yale University

AGRICULTURAL nitrogen in various forms has long been one of the commodities of world trade, but the development of the air-nitrogen industry has greatly multiplied the possible producing centers. The nitrogen situation in our own country is now linked closely with that in many others. We know fairly well what we may expect with regard to the supply of Chilean nitrate, but the air-nitrogen industry is new and we are as yet far from sensing its possibilities. The developments in other countries are matters which concern us, both in their technical and economic aspects.

In Germany a number of interesting developments have been made in the last few years, some of which may be mentioned as having direct bearing on our own problems. It will be recalled that after the war Germany undertook to protect her air-nitrogen industry by excluding Chilean nitrate from her imports. There was, however, a strong demand from agriculture for nitrate nitrogen and eventually the Government allowed small tonnages to enter. Meanwhile the air-nitrogen industry applied intensive research to the problem of converting its products to a more acceptable form for agriculture, this effort resulting presently in the production of several new fertilizer salts. Leuna-saltpeter was one of the first of these to be turned out in bulk. It consists of a mixture of equal parts of ammonium nitrate and ammonium sulphate and is much less hygroscopic than the former salt. It contains both ammonia and nitrate nitrogen and is now widely used in Germany. Recently it has appeared among our imports from Germany, 21,315 tons having been imported during the first quarter of 1926. Mixtures of ammonium nitrate with potassium chloride and with calcium nitrate are also being made in forms suitable for fertilizer.

Germany Markets New Fertilizers

Germany has also put on the market a number of new phosphorus containing fertilizers, such as Diammonphos, carrying 19 per cent nitrogen and 47 per cent phosphoric anhydride; Leuna-phos, which is a mixture of Diammonphos with ammonium sulphate, containing 20 per cent nitrogen with 15 per cent phosphoric anhydride; and finally Leunaphoska, carrying 13 per cent nitrogen, 19 per cent phosphoric anhydride and 13 per cent potash.

Most of these special fertilizer salts were developed in Germany to meet her own agricultural needs. By 1923 the domestic production of nitrogen in Germany overtook the demand and she entered the export market with synthetic ammonium sulphate. In 1924 her exports of this salt amounted to 114,000 tons and in 1925 to 377,000 tons. Her total exports of synthetic nitrogen for the year ending June 1, 1926, are estimated to have been 148,000 tons, the equivalent of 740,000 tons of ammonium sulphate.

Next to developments in Germany those in England are most likely to influence our own situation. The plant at Billingham is now being enlarged under what amounts to a Government subsidy, the Government having guaranteed interest on a $10,000,000 debenture stock issue. The new equipment now being installed will bring the capacity to 70,000 tons of ammonia per year, or more than double the original capacity. Most of this ammonia is converted to sulphate by the gypsum process. It was reported recently that the United Alkali Works were also to enter on synthetic ammonia production, using the Casale process.

Situation in This Country

The air-nitrogen industry in the United States is progressing steadily. The present situation may be summed up as in Table I, the rates of production being estimates based on the last information available.

Table I
Status of Air-Nitrogen Industry in United States, June, 1926

Company	Plant	Process	Present Rate of Production *In Tons of NH_3*	Capacity per Day *In Tons of NH_3*
Atmospheric Nitrogen Corporation	Syracuse, N. Y.	Haber-Bosch	26—27	30
Lazote, Inc.	Belle, W. Va.	Claude	15—18	25
Niagara Ammonia Co.	Niagara Falls, N. Y.	Casale	12	16
Mathieson Alkali Wks.	Niagara Falls, N. Y.		5—10	10
Pacific Ammonia Co.	Seattle, Wash.	F. N. R. L.	3	3
Roessler and Hasslacher Chem. Co.	Niagara Falls, N. Y.		3	3
Belle Alkali Co.	Belle, W. Va.		0—½	1
Total			64—73½	88

In addition to the above plants, the Commercial Solvents Corporation of Terre Haute, Ind., is installing a plant of 15 tons per day capacity and two or three smaller installations are in progress. All of these are synthetic ammonia plants, and their combined capacity by the end of 1926 will be approximately 103 tons of ammonia per day, or say 25,400 tons of nitrogen annually based on 300 days of operation per year. The market for anhydrous ammonia calls for about 15,000 tons of nitrogen per year, and is expanding but probably not fast enough to absorb all the synthetic ammonia available. The aqua ammonia market will take another 24,000 tons of nitrogen per year. The market available outside of the fertilizer field is roughly 51,000 tons, which will apparently be large enough to absorb the synthetic production now in sight.

The next few years will no doubt be critical ones for the air-nitrogen industry in the United States, for the market must be wrested from byproduct ammonia in order to permit the present synthetic plants to operate. Further expansion can not take place until the air-nitrogen products can move into the agricultural nitrogen market, where the price levels are lower and where the exceptional initial purity of the synthetic product is of little advantage.

Promoting the Use of Specifications

Details of certification plan proposed by Bureau of Standards

NOTWITHSTANDING the immense amount of time and labor represented in the formulation of specifications, the fact remains that many excellent specifications well recognized throughout industry are not being widely used at the present time because of the inability on the part of most purchasers to determine whether or not commodities delivered correspond to the specification requirements. A great impetus to the popularizing of the use of specifications could be given by eliminating this disadvantage to the small purchaser.

As a solution to this problem, it has been proposed by the Bureau of Standards to have the seller certify that the commodities delivered have been tested by him and found to comply with certain well-established specifications.

Such benefits as are now derived from the use of specifications by large consumers would be made immediately available in full measure to the small consumer, with incidental advantages to the former of convenience in ordering and accepting commodities and of lessening the price by reason of broadening the field of supply. It would seem evident that to whatever extent the proposed plan could be made effective throughout industry the manufacturers would benefit from the well-known economies accompanying "mass production."

The Federal government is at present the outstanding buyer on the basis of specification and test. Through the Federal Specifications Board the Government has set up master specifications for about 400 commodities which it purchases for its own use. Many of these specifications are directly applicable for industrial use. Further impetus to the policy has been given by the action of State purchasing agents approving the proposal of the Department of Commerce to review the entire field for the purpose of formulating specifications and tests that will make it possible to put State and municipal buying on a specification basis.

With a view to extending this general policy to industrial buying the Bureau of Standards proposes a plan to encourage the maximum number of purchasing agents to make use of the specifications of the Federal Specifications Board. The Bureau proposes to acquaint manufacturers with the F.S.B. specifications relating to their products, informing them that it is preparing lists of manufacturers desirous of supplying commodities in accordance with the specifications and willing to certify that the material thus supplied is guaranteed to comply with the requirements and tests of the specifications. It will be optional with the manufacturer to permit or decline to have his name placed on such a list. This "willing-to-certify" list of manufacturers will then be made available to purchasing agents desiring to buy commodities on a specification basis. The certification plan will be further fortified by published lists of testing laboratories, competent to ascertain whether they do in fact meet the F.S.B. specifications.

The Bureau of Standards has submitted more than 1,000 outlines of this plan to public purchasers, technical societies and trade associations of national standing. Replies thus far received show that the plan will be endorsed by consumer organizations and that the only opposition to the plan as a whole will come from such organizations as are not truly in favor of effective standardization. The lists of "willing-to-certify" manufacturers will be utilized by many purchasers who do not now use specifications because of their inability to determine whether or not commodities delivered correspond to the specification requirements.

Trade Associations Can Assist

Trade associations can co-operate in the proposed certification plan for promoting the use of specifications. They can acquaint their respective industries with the real significance of the proposal and benefits to be derived from it; co-operate in the preparation of specifications; induce association members to put their names on the "willing-to-certify" list; educate dealers and retailers as to the benefits of the plan; and finally, when the time seems ripe, make sure that their members are keeping faith.

It has been proposed that the certification plan should be applied to the specifications of the American Engineering Standards Committee as well as to those of the Federal Specifications Board. Another group of specifications to which the plan might be applied is that of the Society of Automotive Engineers.

In view of the fact that the specifications of the A.E.S.C., the F.B.S., and the S.A.E. are being used rather extensively at the present time, it is believed that no confusion will be created by having the firms certify that the commodities manufactured and delivered on orders based on these specifications do actually comply therewith. In fact, the application of the certification plan to several groups of nationally recognized specifications will serve to draw attention to the present confusion and arouse interest in a greater uniformity.

The list of manufacturers which it has been suggested be compiled by the Department of Commerce is not to be a list of such manufacturers as have actually issued certificates to the Government, but merely a list of manufacturers who say they are willing, when requested to do so by purchasers, to certify that commodities sold under certain designated specifications do actually comply with these specifications.

The existence of a thoroughly classified list of commercial testing laboratories, together with a list of other reliable "checking agencies," will have a number of beneficial effects in promoting the use of specifications, not the least important of which will be the inducement offered to the large number of purchasers who have hitherto hesitated to buy on specifications.

The outstanding fact in the specification situation at the present time is that a very great majority of the purchasers who should be using specification are not doing so. It is to this great group of purchasers that the certification plan will prove most beneficial. If, in addition to obtaining copies of as good specifications as can be written at the present time, all purchasers are able to secure lists of firms willing to manufacture to these specifications and to certify to compliance therewith, and lists of testing laboratories and checking agencies, many of these purchasers will readily adopt the specification method of buying. This is especially true of the purchasers of states and municipalities who are anxious to use specifications but have not thus far felt justified in doing so because of inability to determine whether or not the commodities comply with the specification requirements.

Fabricating Heavy Equipment by Welding

Description of methods used for making kilns and tanks that have proved to be successful

By A. O. Miller
The Reeves Brothers Co., Alliance, Ohio

WELDING for the manufacture of small and light equipment used in the chemical engineering industries has met with wide acceptance and the method is being more and more used each year. However, when it comes to using this method for the manufacture of heavy equipment, experience is not so wide and many hesitate to adopt it.

In this connection some of the work done at our plant in recent years will be of interest as showing that welding can be applied successfully to heavy work.

Early in 1923 an order was placed with us for 3 rotary lime kilns. These were of steel plate and were 8 ft. inside diameter and 125 ft. long, with a thickness of plate of ⅜-in. Two tires with 14 in. bases, resting on a 4-roller base supported the kiln so that it could be rotated by driving gears, making one revolution in 1 min., 19 sec. Being supported at only two points it is subjected to alternating stresses as the kiln rotates. A point that is in compression when the shell is in one position is in tension when it has rotated 180 deg., thus giving a complete reversal of stress every half revolution.

Two of these kilns were made by riveting, and the third was made by oxy-acetylene welding, in order to test the method.

As the welding of such heavy cylinders had not been previously attempted the details of the procedure presented many problems. One of the first of these was to obtain proficient welders. It was found that this could be done by selecting several good men and putting them through a thorough course of training, prior to the actual work on the kiln.

In fabricating such a cylinder there are two types of seams: Girth seams extending around the circumference of the cylinder, and longitudinal seams extending from one end to the other. The plates for the cylinder were beveled in the mill as follows: For longitudinal seams, 100 to 110 deg. single V with 3/32-in. flat contact edge at the bottom of V; for girth seams, 90 deg. double V with 1/16-in. flat contact at center. All rivet holes for attaching the tires were punched in the mill and the plates were rolled to the proper radius before welding began.

The longitudinal seams of all sections were welded first and the cylinders thus formed were then welded together to form the shell. Nickel-steel welding rod was used throughout.

For welding the longitudinal seams the sections were set on rollers, tack-welded at one end, and the other spread ¼ in. per ft. or about 2 in. total. These seams were then welded from the outside only, the welder taking particular care to see that the metal fused through to the bottom of the V. Some of the plates were longer than these 8-ft. plates referred to above, but the general procedure was the same.

In welding the various cylindrical sections together at the girth seam to form a continuous shell, it was necessary that the ends be not more than ⅜ in. out of true when the shell was completed. In fact, after completion it was found that the two ends were only ⅛ in. out of line. The welding of these girth seams was done as follows: Adjacent sections were carefully lined upon rollers and spaced ⅜ in. apart at the ends being held by tack-welds at the quarters. Welding was done by two men, one working at the top on the outside weld, and the other working inside the cylinder on the inside weld, the cylinder being turned as necessary.

In this particular job, since it was the first of its kind, the welded kiln cost considerably more than its riveted counterparts. However, with the experience gained duplicates could be constructed at a much lower figure. There is another factor that further decreases the cost. In the case mentioned above the shell of the welded kiln was of the same thickness as those of the riveted kilns. However, recently, after the kilns had been in practically continuous operation for nearly two years, a stress analysis was made on both types. The results indicate that a thinner welded shell, costing much less to fabricate would still have been stronger and more satisfactory than the riveted shell.

The test showed that at no point did the stress exceed 3,000 lb. per sq.in. the kiln running empty. This very low value seemed to indicate that the shell was thicker than was really necessary. In order to check this it was necessary to consider the effect of the load conditions. The kiln shell exclusive of driving gear and tires weighs 85,300 lbs., and the firebrick lining weighs 273,300 lbs., making a total of 358,600 lbs. The normal load of limestone and lime is about 45,000 lbs., but under certain conditions a ring may form in the kiln in the discharge end backing up the charge. The maximum load under these conditions is assumed to be 151,000 although this would probably never be reached in practice. Using these values shell stresses were calculated for both ⅜-in. and ½-in. thicknesses. It was found that even at maximum load the safety factor for the ½-in. shell would be 6.4 based on the elastic limit.

Reducing the shell thickness from ⅜-in. to ½-in. would result in saving about 8 tons of steel as well as reducing the welding cost at least one-third. A corresponding reduction of costs in other items such as handling and freight would be made. Taking all these together, the cost of the welded kiln would be reduced well below that of the riveted kiln.

The same stress analysis showed very clearly that for the riveted kiln the ⅝ in. thickness of plate was necessary. Even with that thickness, after two years' operation the apparent stresses in the riveted joints were from 2 to 2½ times those actually existing in the welded joints. Due to the continually alternating stresses set up in the kiln shell, failure of some of the rivets is certain to occur. In fact, operators of riveted rotary kilns must expect to shut down before many years, rip out the lining and redrive some of the rivets. With welded construction this necessity vanishes so that a decided reduction in operating costs can be added to the savings noted above. This fact has been brought out by operating records.

Four tanks to be used with a working pressure of

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125 lb. per sq.in., in storing a volatile liquid at 70 deg. F., have been welded at our shop. These tanks are 7 ft. inside dia., and 35 ft. long. The shells are of $\frac{11}{16}$-in. plate with one head of 1-in. plate and other head of $1\frac{1}{8}$-in. plate. Both heads were curved outward and flanged in for securing to the shell. An 11x15-in. pressed steel manhole is provided in the center of the $1\frac{1}{8}$-in. head. These tanks were double V welded inside and out by the oxy-acetylene process and tested to both 250 and 375 lb. per sq.in.

As in the fabrication of the kiln the first problem on this job was the selection and training of welders. The material was then selected and it was decided to use $\frac{3}{4}$-in. plate in place of $\frac{11}{16}$-in. The shell plates were first edge-planed to size and then double beveled on all four sides leaving $\frac{1}{16}$-in. flat surface between the two bevels on each edge. The shell of each tank consisted of two courses each made up of 3 plates or a total of 6 plates per tank. After this beveling the plates were rolled to the proper curvature. Heads were formed from circular plates which were dished to a 7-ft. radius and then flanged so that the knuckle was about 3 in. from the edge of the head. With this design, the girth weld joining the head and the shell is away from the knuckle where the stresses are quite high. At the knuckle, the longitudinal forces along an element of the shell and the radial forces on the dished end resulting from internal pressure are at an angle to each other. This results in a component acting toward the center of the tank which tends to contract the knuckle and adjacent sections forcing them towards a more hemispherical shape. For this reason the welded joint is placed well outside of the highly stressed knuckle zone where the stresses are lower.

The three curved plates each 17 ft. 3 in. long x 89 in. wide forming each shell course were fastened together and tied up by means of clamps. The course was then set so that the seam to be welded was at the top, the welding being done from scaffolds. It was found that a spacing of $\frac{1}{8}$ in. at the starting end and a spread of 3 in. at the far end gave the best allowance for contraction in the seam. Each course was welded first entirely from the outside, and the inside seam was then chipped out clean before completing the welds from that side.

For welding the two courses together they were lined up on rollers spaced with a minimum of $\frac{1}{2}$ in. and the seam tacked inside and out in 8 places. Welding was then started from opposite sides of the tanks between the tacks, one welder working on the outside V and the other on the inside V. When the two welds came together the unwelded V was chipped clean and the seams then completed. Girth seams joining the heads to shell are made in the same manner as the seams above. The manhole was welded into the manhole head before the head was welded to the shell.

The test was made by hydraulic pressure and was first carried at 250 lb. per sq.in. At this pressure all welds in the tank were hammered first with a 3-lb. sledge and then with a 5-lb. sledge. The pressure was then raised to 375 lb. per sq.in. and held there for 3 minutes. There was no evidence of deformation in the tank nor did any weld leaks develop. These tanks have been in service for some time now and have given satisfactory results under severe operating conditions. As a result a number of other similar tanks have been ordered for the same type of work.

That the work described above is only a preliminary step in the application of the welded designs in chemical equipment, is borne out by the fact that we are at present welding another large chemical storage tank designed for working pressure much higher than those described above. It is not possible at this time to give further details on this last mentioned tank.

As in the case of the kiln, the cost of these welded tanks has been slightly greater than a riveted job, but this has been due to the fact that it has been pioneer work, with no developed procedure to follow. In any case the difference in cost is well made up by the fact that the tanks are leak-proof. Aside from this, however, there is every indication that investigations now under way will result in greatly reducing the first cost of heavy welded tanks. The field is one of great promise and it merits the close attention of all manufacturers of chemical equipment.

Tung Oil Production Succeeds In the United States

Florida and other parts of the South prove suitable for growth and output of chinawood oil

By Morris A. Hall
White Plains, N. Y.

TUNG OIL, variously called chinawood oil and wood oil, which has hitherto been produced only in the uplands of China, has recently been brought into production in the United States. It is now being grown in northern Florida, and apparently from the experiments conducted there may be grown in any place that is not subjected to killing frosts for more than one or two days a year.

There are 2,500 acres planted. The plantations consist of 300 acres planted by the American Tung Oil Corporation, formed from the membership of the American Paint & Varnish Association, 700 acres planted by the former president of that association, and the balance in small groves scattered over the northern part of Florida.

The tree is of quick growth and rapidly comes to sufficient size for the production of nuts. A 2-year-old tree will produce about 100 nuts. Commercial quantities are produced by the fourth or fifth year and the maximum yield is reached about the eleventh or twelfth year, continuing thereafter. The oldest tree in the United States is only about 17 years old, and still producing in large quantities. In China it is said that with no care or attention these trees reach ages of 40 or 50 years.

The trees are small and of such a nature that they may be planted rather closely, or interplanted with other larger and less tolerant forms. It has been suggested that they might be interplanted with pecans. These latter trees reach a height of 50 or 60 ft. and require spacing of 60 ft. The tung trees do not exceed 30 ft. in height and when planted alone it is suggested that they can best be planted at spaces of $12\frac{1}{2}$ ft. in rows 25 or 30 ft. apart. In the seventh or eighth year every other tree of such a planting should be removed leaving a permanent spacing of 25x25 or 25x30 ft.

One pound of oil is secured from 3 lb. of nuts. A gallon of this oil will weigh 8 lb. Based on what is known of the trees in this country, the following table gives a reasonable estimation of production which may be expected, based on 12x30 ft. planting with later removal of half of the trees:

	Nuts per Tree Unhusked in Bushels	Oil per Tree Gal.	Oil per Tree Lb.	Value per Acre @ 15c. per Lb. in Round Figures Oil Only
Fourth year	0.50	0.37	2.9	$50
Fifth year	1.00	0.70	5.6	100
Sixth year	2.20	1.50	12.0	210
Seventh year	3.00	2.20	17.6	310
Half the trees removed after seventh year.				
Eighth year	3.70	2.60	20.5	175
Ninth year	3.85	2.70	21.6	185
Tenth year	4.10	2.85	22.8	195
After tenth year	4.30	3.00	24.0	200 plus

From a farmer's standpoint, the pomace from the pressed seed has almost as great a value for fertilizer as the oil has for its uses. The weight of this press cake is about two-thirds the weight of the unpressed seed. It contains from 5.6 to 6 per cent of ammonia. Due to a poisonous content it is not suitable for cattle feed, but its high ammonia content gives it distinct value as a fertilizer. The nut production in the table above would give the following yields of pomace:

	Lb. per Acre
Fourth year	662
Fifth year	1,276
Sixth year	2,736
Seventh year	4,009
Eighth year	2,338
Ninth year	2,462
Tenth year	2,667
After tenth year	2,736 plus

The fruit of the tung tree consists of a husk containing from 3 to 5 nuts. A pile of this fruit is shown in Fig. 1, and Fig. 2 shows cross-section of a husk containing five nuts. Occasionally the number of nuts in a husk is greater and as many as eleven have been found in one husk. When the nuts are pressed without removing the husk or seed coats the production is 30 to 34 per cent of oil. Methods used in China are cruder and produce but 20 per cent. Gardner has found that American tung nuts properly handled in the Anderson expeller with husks removed but kernels cracked and not removed, will produce 34 per cent of oil.

In China it is the practice to let the nuts fall from the tree naturally and remain on the ground for a considerable time until the husks crack open. In following this method fermentation frequently sets in, causing changes in the oil and the natural pigments of the seed, with the result that the oil is darker and of poorer quality.

In its natural state the oil is colorless and neutral in reaction. When it is recovered by cold pressing, the color is light. Its peculiar properties are due to the elaeomargaric acid that it contains.

The pure oil has a high specific gravity, exceeded only by castor oil. It has a refractive index higher than any other known oil. It has an exceptional drying power, much better than linseed oil. It has a high viscosity. When heated to 250 deg. C. or higher for a few minutes and then cooled it solidifies, forming a firm jelly that crumbles readily and is not sticky. It is quite poisonous. It is neutral, whereas Chinese oil contains about 7 per cent of free acid. The jelly test determines its purity, for adulterated oil gives a gel that is soft, sticky and will not crumble.

From 1910 to 1914 imports from China averaged 47,890,000 lb. annually. In 1922, 79,089,000 lb. were imported, in 1923, 87,292,000 lb., and in 1924, 81,588,000 lb. In 1923 the price in China was 15.4 cents per lb., and in 1924, 13.6 cents. In recent years the average price has been 14½ cents, with an upward tendency. The oil is composed principally of the glyceride of this acid, or elaeostearic acid as it is sometimes called. This has the composition $C_{18}H_{32}O_2$, and is a stereoismeride of linoleic acid. The oil also contains 10 per cent or less of the glyceride of oleic acid and 2 to 3 per cent of saturated fatty acids, according to H. A. Gardner and J. Lewkowitsch.

The following standard requirements for raw tung

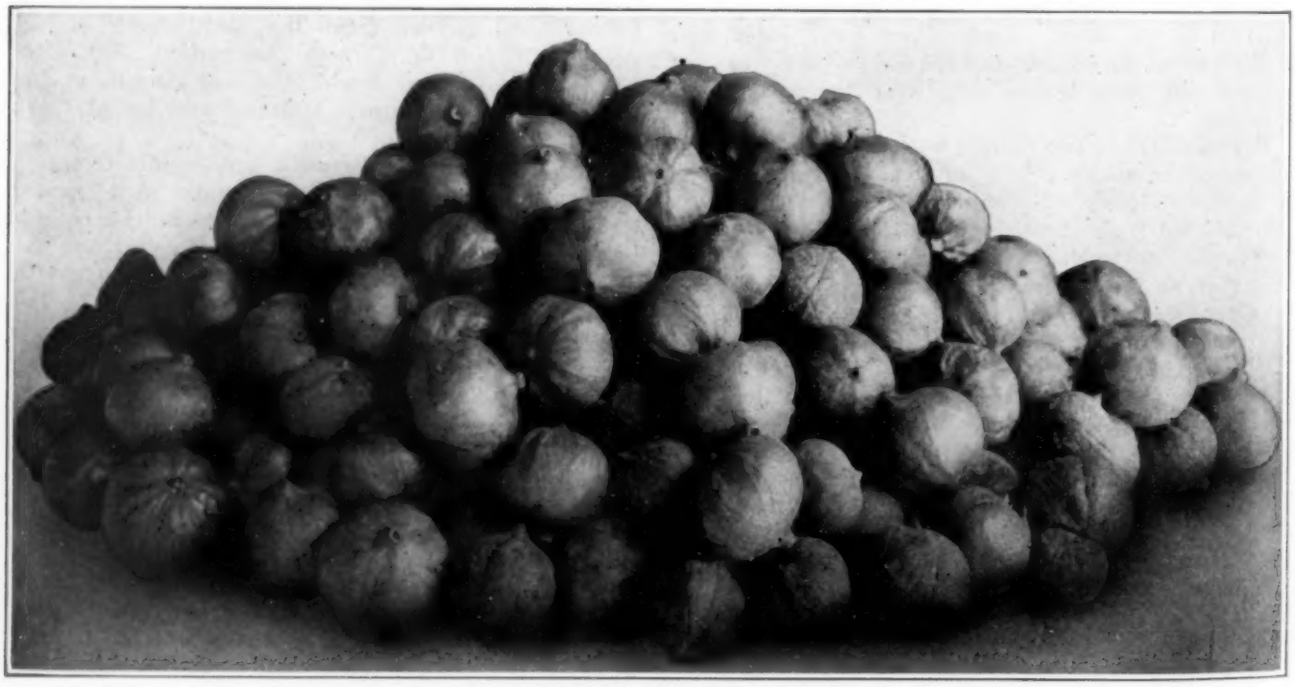

Fig. 1—Tung Fruits from Florida Grown Trees
Inside the husk of each of these fruits are from three to seven nuts from which oil is obtained by expression

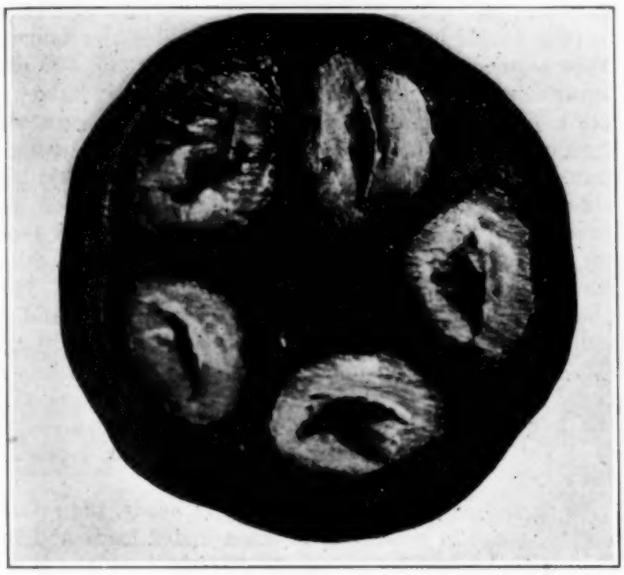

Fig. 2—Cross-Section of a Tung Fruit
This shows five nuts within the husk, each nut containing a crescent shaped kernel

oil have been adopted by the American Society for Testing Materials and approved by the Paint Manufacturers' Association of the U. S. and the National Varnish Manufacturers' Association:

	Maximum	Minimum
Specific gravity at 15.5 deg. C	0.943	0.939
Acid number (alcohol-benzol)	7.0	.....
Saponification number	195.0	190.0
Per cent unsaponifiable matter	0.76	.....
Refractive index at 25 deg. C	1.52	1.515
Iodine number (Wijs)	.....	163.0
A.S.T.M. heating test, minutes	12.0	.....

Continued planting, and the arrival at bearing age of trees now planted, will produce large quantities of American grown nuts, making large quantities of the oil available. The expansion of its usefulness is likely then to become a chemical engineering problem.

Suggestions for High Pressure Research Equipment

Rapid increase in the manufacture of synthetic products by the use of high pressures demands the development of suitable apparatus

By F. A. Ernst
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THE SUCCESSFUL, economical and safe employment of high pressures from 100 to 1,000 atmospheres for the synthesis of ammonia, has paved the way for the use of such high pressures in a wide field of chemical reactions. Already synthetic alcohol, urea and other materials are coming into commercial production, while serious consideration is being given to other high pressure reactions and in many cases investigations have started.

With the introduction of these high pressures, severe requirements in materials must be met and proper safeguards provided. Superimposed on high pressures in many cases is the further difficulty of relatively high temperatures and of corrosion. In meeting these conditions, a new technique for high pressure-operation is being developed. Current engineering practice in this new field is developing and changing rapidly. The equipment for the most part is not standard and cannot be secured commercially, ready for installation.

As a result of six years of investigation of some high-pressure reactions at the Fixed Nitrogen Research Laboratory, a mechanical technique has been developed which has proven quite satisfactory. Some suggestions growing out of the experience of this laboratory will be offered in this paper.

Selecting Materials

In selecting the materials for fabrication of equipment to withstand the severe conditions, choice can be made from among the carbon steels, the alloy steels and the non-ferrous alloys. Carbon steels vary in carbon content from the 0.04 per cent commercially pure iron to the 1.4 per cent tool steel. The tensile strength of these steels in the annealed state is almost proportional to the carbon content.

With an increase of carbon, however, there is a marked increase in cost, both of material and of working. The high-carbon steels, therefore, have not found great use for withstanding high pressures. By proper heat treatment the tensile properties of mild steels can be increased to equal those of high-carbon steels.

Where still greater strength is required resort can be had to the alloy steels. At this time the most important and widely used elements in alloying steel are nickel, chromium, and vanadium, either singly or in combination with each other. According to Abbott, the presence of each 0.01 per cent of nickel in a steel up to 8 per cent increases the tensile strength by 42 lb. per sq.in. A 5 per cent nickel, carbon steel would have a tensile strength of 21,000 lb. greater than a corresponding carbon steel. Such an increase in strength is, of course, important and valuable. Of vastly more importance, however, is the effect of heat treatment. Proper heat treatment of nickel steel increases the strength enormously without materially lowering its ductility and toughness.

The addition of chromium does not raise the tensile strength greatly, but by associating with carbon forms double carbides which, though extremely hard, are not so brittle as is iron carbide. To obtain its maximum advantages a chromium steel should be heat treated. In the annealed state it is no stronger than the plain carbon steel of the same carbon content. As a heat-treated chromium steel is less brittle than carbon steel of the same hardness it is usually better to obtain the desired hardness by increasing chromium rather than by adding more carbon.

Besides its mechanical properties chromium increases the resistance of steel to corrosion. This corrosion resistance and its hardness as well is bringing chromium into great demand for chemical equipment not alone for alloying with steel but for electroplating as well. Stainless steel contains 12 to 14 per cent of chromium, while 22 to 28 per cent chromium steel is now being produced as a heat-resisting steel and sold under various trade names.

Vanadium is seldom used alone for alloying steel. Its value lies in its deoxidizing and degasifying effects

Abstracted from a paper read before the Associated Technical Societies of Cleveland during the Exposition of the Association of Chemical Equipment Manufacturers, Cleveland, Ohio, May 10 to 15, 1926.

on steel. Because of the extreme hardness and very high cost vanadium is not used in steels in quantities over 1 per cent. In fact, in practically all the commercial steels vanadium is present in amounts less than 0.2 per cent. Vanadium as an alloy for steel is usually employed together with chromium. Under these conditions it has a very powerful effect on the steel even when present only in small quantities.

Where corrosion must also be considered additional chromium may be added. For the conditions within an ammonia converter, where the pressure sustaining vessel must also withstand the active, hot, reducing ammonia gases at temperatures up to 500 deg. C., a 2.5 per cent chromium, 0.2 vanadium, 0.37 carbon steel have been found very effective. For temperatures above this, the nickel-chrome alloy "Nichrome" has been used successfully.

Design of Equipment

For compressing gas for laboratory purposes, the system should be as simple as possible, requiring but minor attention. As the quantity of gas required as a rule is relatively small, use can be made of a water plunger. By means of a hydraulic pump, the water plunger is raised in the compression cylinder, compressing above it the gas admitted from the storage system. This compressed gas is then discharged to a storage cylinder and the water drained out of the compression cylinder ready for another compression. If the gas in the storage system is at holder pressure, the compression process must be rather slow. However, as compressors for delivery pressures up to 3,000 lb. per sq.in. are readily obtained commercially, much time can be saved by precompressing the gas to about 200 atmospheres.

A storage cylinder 3 in. in dia. x 4 ft. high with a contents of about 335 cu.in. would contain, at 1,000 atmospheres and 25 deg. C., approximately 110 cu.ft. of a mixture of 3 parts of hydrogen and 1 part of nitrogen. In operation with both the compression and storage cylinders filled with gas at or slightly above the operating pressure, the pump need be operated only intermittently for a few revolutions at a time to keep up the pressure sufficiently high for the ordinary laboratory work. Hydraulic pumps are available commercially for service at pressures even above 1,000 atmospheres.

In measuring such pressures a dead-weight gage has been found more practicable than the dial or Bourdon tube gages that can be obtained commercially. In such a dead-weight gage, with a reservoir about two-thirds full of oil, the gas pressure entering the top of the reservoir is transmitted to the end of a piston by pressure acting through the oil. This piston is balanced by means of graduated weights placed on the disk on the top end of the piston and also by means of weights the effect of which is transmitted to the piston through a lever arm and yoke. The lever arm has a 5 to 1 ratio thus greatly reducing the necessary balancing load for the pressure.

The finishing of the piston and cylinder is of major importance in making such a gage. The fit must be such that there is practically no leakage of oil past the piston. In the case of the gage now in operation at the Fixed Nitrogen Research Laboratory, the piston is finished to 0.19254 in. while the cylinder is 0.19275 in., making a difference of 0.0002 in. in the diameter. To make such a cylinder a piece of material about twice as long as the finished cylinder was drilled and reamed. This reamed hole was then lapped, using No. 600 carborundum. In these operations the cylinder tends to get a bell mouth at each end. The excess length was then cut off, one-half from each end leaving, by using a thin mixture of oil and carborundum for the final lapping operation, a perfect cylinder. The piston then was made to fit the cylinder and the weight figured from the finished piston. A plug was made to fit the cylinder for use as a sizing plug for cutting the piston. This plug consisted of a split cylinder with an expanding cone. The piston stock was then cut, ground to the size of the plug, and finished by polishing with crocus cloth. Finished in this way, the fit is so close that the gage has been in daily operation at pressures up to 1,500 atmospheres without necessity for replacing the oil.

In designing converter or autoclave heads, the retaining bolts are in compression when under loads and the bolt circle should be as nearly directly over the mean circumference of the gasket as possible thus reducing the moment in the head. The use of small bolts should be avoided. Bolts used should be as large as possible for the particular setup. Gasket material should be copper, silver or some other soft metal which will actually flow under the pressure of the bolts, so that it fills up the small V grooves cut in both the cylinder and the head.

Electric Connections

Where electric current is used it is frequently necessary to make a connection that will withstand the pressure of the chamber and at the same time will act as an insulation between the walls of the chamber and the entering lead. In making such a joint soapstone was used for the insulating material. This was "selected soapstone" which is cut with its faces parallel and perpendicular to the cleavage of the block. This soapstone is cut into double-ended truncated cones with the contained angle of the cone less than 60 deg., preferably 59 or even 58 deg. The seat and follower ring are then cut to a 60-deg. angle. As pressure is applied by means of the tightening gland, the tip of the cone may crumble, but line contact rather than surface contact is maintained. It has been found that when such a joint is properly made, the actual seal is secured at a point near the small end of the cone. If high-pressure cylinders are to be tested hydraulically before using, the hole in which the soapstone cone is to be used should be plugged, as soapstone deteriorates rapidly in water and will not hold the pressure. It will, however, hold its pressure in the presence of oil.

High-pressure tubing for this class of work can be secured commercially in almost any needed size.

A very effective pump or compressor valve is one of such relatively large diameter that the lift is exceedingly small. Such a valve breathes rather than pounds on its seat. Because of this the seat can be made to approach a knife edge in width and likewise the gas seal can approach line contact. This valve was found to be very effective. Because of its size it is not possible to cut it directly into the head of the pump, but it must be made separately. A satisfactory pump packing consists of alternate rings of babbitt and steel. With this packing, the packing gland need be turned only hand tight but will hold absolutely tight.

Protecting Thermocouples by Transparent Silica Tubes

While ordinary fused silica tubes permit contamination in reducing atmospheres the transparent do not

By R. A. Ragatz and O. A. Hougen

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IT IS well known that the use of the ordinary fused silica protection tube of the translucent type permits serious contamination of the enclosed thermocouple when the tube is surrounded by a reducing atmosphere at high temperatures. Apparently this contamination is caused by the porosity of translucent silica which permits the penetration of reducing gases to the interior of the tube. Furthermore, when heated for extended periods above 1050 deg. C. such tubes rapidly devitrify and crumble, as shown in Technical Paper 170, U. S. Bureau of Standards, pages 90 and 91. A previous investigation, reported in *Chem. & Met.*, Vol. 29, p. 662, 1923, showed that this contamination became apparent at temperatures above 900 deg. C., in a reducing atmosphere. When the translucent tubes were heated for 50 hours at 1000 deg. C. in an atmosphere containing carbon monoxide the enclosed noble metal couple showed a ¾ per cent decrease in emf. and the enclosed chromel-alumel couple a 4 per cent reduction in emf.

Because of the recent development of a new fused silica protection tube of the transparent type, it was deemed desirable to perform similar tests upon this new type of material. Twelve such tubes of the following average dimensions were obtained from the Thermal Syndicate: length, 12 in.; diameter, 0.4 in.; bore, 0.2 in.

The experimental equipment used herewith was essentially the same as that used in the previous investigation with the following additional improvements: the use of a solid graphite cylinder instead of powdered graphite for enclosing the protection tubes and maintaining a reducing atmosphere, the use of a glazed alundum tube impervious to gases for the heating furnace and the use of reversing switches to compensate for stray contact emf. in the potentiometer circuit.

Two types of couples were used in these tests, a base metal couple of chromel-alumel and a noble metal couple of platinum—platinum-10 per cent rhodium. These couples were newly constructed and were annealed and calibrated before testing. The plan of procedure was to insert these couples into transparent silica tubes and to subject them to a series of heat treatments of 50 hours' duration each at various temperatures with the tubes surrounded by a reducing atmosphere of carbon monoxide. After each heat treatment both thermocouples were recalibrated at the melting points of zinc and aluminum furnished by the Bureau of Standards. In the testing furnace the protection tube and the enclosed thermocouple were immersed for a distance of 6 in. into the heated reducing zone. Upon calibration, fully 4 in. of this same portion of the thermocouple were in a region of steep temperature gradient, this arrangement readily permitting detection of any contamination which might have occurred in the testing furnace. For each set of heat treatments at a given temperature a different pair of protection tubes were used. Visual examination of the transparent protection tubes after each heat treatment showed no alteration except for the tubes heated at 1200 deg. C. In this case slight surface devitrification was noticed after the end of the first 50-hour period and was more pronounced at the end of 100 hours.

Table I—Effect of Various Heat Treatments Upon the Emf. of Thermocouples Protected with Transparent Silica Tubes Placed in a Reducing Atmosphere Containing Carbon Monoxide

Heat Treatments	Noble Metal Couple		Chromel-Alumel Couple	
	Zinc Point 419.4°C.	Aluminum Point 658.7°C.	Zinc Point 419.4°C.	Aluminum Point 658.7° C.
	Millivolts	Millivolts	Millivolts	Millivolts
Original, after annealing	3.432	5.817	17.42	27.64
First 50 hr. period at 1000°C.	3.435	5.822	17.50	27.78
Second 50 hr. period at 1000°C.	3.435	5.824	17.54	27.82
Third 50 hr. period at 1000°C.	3.435	5.823	17.55	27.85
Fourth 50 hr. period at 1000°C.	3.435	5.824	17.56	27.84
Fifth 50 hr. period at 1000°C.	3.434	5.823	17.67	27.84
Sixth 50 hr. period at 1000°C.	3.436	5.827	17.77	27.92
First 50 hr. period at 1100°C.	3.432	5.820	17.90	27.95
Second 50 hr. period at 1100°C.	3.432	5.817	18.01	27.93
First 50 hr. period at 1200°C.	3.431	5.817	Couple* broke	27.96
Second 50 hr. period at 1200°C.	3.433	5.820	.....	.....
Final after annealing electrically	3.432	5.817	.....	.....

* Broke due to excessive oxidation by air enclosed in tube.

Table II—The Effect of an Oxidizing Atmosphere Upon Chromel-Alumel Thermocouples

Heat Treatments	Couple 1		Couple 2	
	Zinc Point 419.4°C.	Aluminum Point 658.7°C.	Zinc Point 419.4°C.	Aluminum Point 658.7°C.
	Millivolts	Millivolts	Millivolts	Millivolts
Original, after annealing	17.41	27.63	17.39	27.63
First 50 hr. period at 1000°C.	17.52	27.74	17.51	27.75
Second 50 hr. period at 1000°C.	17.54	27.74	17.53	27.78
First 50 hr. period at 1100°C.	17.67	27.76	17.71	27.81
Second 50 hr. period at 1100°C.	17.71	27.70	17.72	27.75

The constancy of emf. of the noble metal thermocouple, as noted in Table 1, indicates that no contamination has occurred. The gradual rise in emf. of the chromel-alumel couple was not due to contamination by reducing gases, because as shown by the previous experiments, contamination by such gases causes a reduction in emf. It was suspected that this gradual increase in emf. was due to some other cause, probably the oxidation of the thermoelements by air enclosed in the protection tubes. This supposition was tested experimentally by subjecting two new chromel-alumel thermocouples to a series of heat treatments in an oxidizing atmosphere of air for periods of 50 hours each at various temperatures. The results, given in Table 2, show a steady rise in emf. due to oxidation.

Besides the above method of testing for contamination, homogeneity tests by the traverse method were made on the noble metal thermoelements after the last heat treatment. In this method, as shown in Technical Paper 170, U. S. Bureau of Standards, pages 228 to 232, the used thermoelement was moved in contact with one end of an unused thermoelement of the same composition with the point of contact maintained at 750 deg. C. The contact emf. was recorded at regular distances along the thermoelement under test. The maximum variation in emf. along the used thermoelements was only 6 microvolts, indicating that the thermoelements had suffered no appreciable contamination. In the purest thermoelements, variations of this magnitude may be expected.

Feasibility of Coke-Oven Hydrogen for Synthetic Ammonia

Possibilities of progress depend upon profitable recovery of light oils and utilization of a byproduct ethylene mixture for conversion to alcohol

By Barnett F. Dodge
Fixed Nitrogen Research Laboratory

THE importance of a cheap source of hydrogen in any process for the fixation of nitrogen through ammonia synthesis has been stressed by all who have given attention to this problem. Claude in France was apparently the first to give serious thought to the possibility of obtaining the hydrogen from coke-oven gas. [G. Claude, *Compt. rend.*, vol. 172, p. 974 (1921); *Compt. rend.*, vol. 176, p. 394 (1923); *Chimie et Industrie*, vol. 11, p. 1055 (1924); *J. Ind. Eng. Chem.*, vol. 14, p. 1118 (1922)].

The experiments which he has made toward the separation of hydrogen from coke-oven gas have culminated in the location of a plant at the Bethune Mines which is said to be in successful operation. Claude writes enthusiastically of the great advantages of extracting hydrogen from gas that is otherwise purely a waste product; but all his publications lack any actual figures on the economics of the process. Furthermore, conditions in the coke-oven industry in this country might be quite different from those in France, and distinctly unfavorable to the utilization of this gas as a source of hydrogen. In order to obtain more definite information on this important subject, with particular reference to American conditions a preliminary survey was made at the Fixed Nitrogen Laboratory. The results of this survey, which are summarized below, were obtained with a view to finding some kind of an answer to the questions:

1. How much coke-oven gas might be available for this purpose and what value or values could be assigned to it or the hydrogen contained in it?

2. Having arrived at a value for the hydrogen, how would a liquefaction process for extracting hydrogen from coke-oven gas compared with other methods for preparing the hydrogen for ammonia synthesis, particularly with the water gas catalytic process?

The fixation of 1 ton of ammonia will be taken as a basis for estimation, and 70 deg. F. and 14.7 lb. per sq.in. will be taken as a standard condition for gas volumes. On this basis, the theoretical hydrogen requirement would be 68,000 cu.ft. To estimate the practical coke-oven gas requirement, there has been assumed a 10 per cent loss of hydrogen in ammonia synthesis due to purges and leakage (Report on the Fixation and Utilization of Nitrogen, No. 2041), a 10 per cent hydrogen loss in the water scrubbing to remove Co, [R. S. Tour, *Chem. & Met. Eng.*, vol. 26, p. 359 (1922)] and of the hydrogen going into the liquefaction process, there is assumed an extraction of 90 per cent, the remaining 10 per cent being dissolved in the liquid fraction (H. S. Taylor, "Industrial Hydrogen"). For a typical run-of-oven gas containing 48 per cent hydrogen, the above assumptions lead to a gas requirement of 195,000 cu.ft. per ton of NH_3.

The U. S. Geological Survey's yearly publication of statistics for the coke industry furnishes much valuable information on the amount of gas produced and its distribution among various uses. In the following table are collected some of the most pertinent figures covering the period from 1920-24 inclusive.

Table I—Coke-Oven Gas Production and Distribution
(Volumes of gas are expressed as million cu.ft.)

Year	1920	1921	1922	1923	1924
Total gas produced	476,500	310,200	442,700	601,200	541,100
Gas used for oven heating	235,600	147,000	203,200	.....	.....
Gas used in steel and affiliated plants	151,800	98,400	145,000	200,100	187,200
Gas distributed through city mains	53,200	43,800	57,000	65,100	65,700
Gas sold for industrial use	Included in preceding item		10,350	19,500	18,600
Gas burned under boilers	25,400	12,120	19,120	33,800	29,800
Gas wasted	10,380	8,860	8,050	.....	.....
Per cent of total gas used for oven heating	49.5	47.4	45.9	.....	.....
Per cent total gas used in steel and affiliated plants	31.8	31.7	32.7	34.3	34.6
Per cent gas distributed through city mains	11.2	14.1	12.9	10.8	12.1
Per cent gas sold for industrial use	.....	.....	2.3	3.2	3.4
Per cent gas burned under boilers	5.3	3.9	4.3	5.6	5.5
Per cent gas wasted	2.2	2.9	1.9	.....	.....

The bulk of the gas, about 80 per cent, is thus utilized for oven heating and for various heating purposes in affiliated steel plants. The hydrogen in this gas would suffice for the fixation of very large amounts of nitrogen, but this use of the hydrogen would be competing against a well-established heating use. It is well known that the ovens may be heated with blue water gas and the new Becker type of oven made by the Koppers Co. permits the use of producer gas. In fact the use of producer gas for oven heating has been stated to have several advantages over the use of coke-oven gas (H. C. Porter, "Coal Carbonization"). If all the hydrogen were extracted from the gas used for oven heating and the deficiency in heating value made up by the addition of producer gas, the amount of coke necessary for the production of this producer gas would only amount to 4 per cent of the coal carbonized, which is less than the amount of coke regularly produced in the form of breeze and screenings. This form of coke, which is either wasted or disposed of at a very low figure has been successfully used to make producer gas.

Any satisfactory figure for the value of the coke-oven gas that is used for oven heating or used in steel plants is hard to obtain. In the bulletin of the Geological Survey for 1922 the gas used in steel mills was valued by the coke-oven operators at from $0.06 to

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$0.30 per M, the average for the whole industry being $0.11. This is certainly too low and is probably merely a bookkeeping value. It would not be a safe value on which to base any cost figures on a nitrogen fixation process. An approximate estimate of the value of the hydrogen in this gas might be obtained from the value of an equivalent amount of substitute gaseous fuel, either producer gas, natural gas, or water gas. Tests on producer-gas fired ovens have shown that about 3.6 times as much producer gas as coke-oven gas must be used. Assuming that producer gas of 135 B.t.u. can be made from coal at $4 a ton for about 6c. per M cu.ft., total cost at the burners, coke-oven gas would be worth $0.21 per M, or the hydrogen in it would be valued at

$$\frac{320}{560} \times \$0.21 = \$0.12 \text{ per M.}$$

On the basis of replacement of the hydrogen by blue water gas, it would be valued at $0.18 to $0.20 per M. If the hydrogen could be replaced by producer gas from coke breeze, it might be valued at about $0.10 or even less.

There remains as a possibility the 8 to 9 per cent of the gas which is either wasted, burned under boilers or sold for various industrial heating purposes. The total amount of gas included in these items for the year 1922 (the last year for which complete returns have been published by the Geological Survey) was sufficient for the fixation of 270,000 tons of NH_3. However, this amount of gas was distributed among some 65 to 70 plants and it is important to determine the maximum amounts available at individual plants and how steady the supply is likely to be. For example, if gas were wasted in a very intermittent manner, large storage facilities would be necessary which would be likely to prove a serious obstacle in the way of utilizing such waste gas for NH_3 synthesis. Data for individual plants have been obtained through the courtesy of F. G. Tryon of the Geological Survey and by the aid of questionnaires sent to certain of the plants.

Considerable amounts of gas are regularly burned under boilers. Since this constitutes a fairly low-grade use for the gas, it is reasonable to suppose that gas so consumed is a possible source of hydrogen for NH_3 synthesis. The use of large amounts of gas in this way occurs mostly at those plants that are not operated in connection with steel plants. Most of this gas could probably be made available at a steady rate to an outside consumer by utilizing blast furnace gas, tar, coke breeze and coal for firing the boilers. The value of this gas as reported by the coke-oven operators to the Geological Survey for the year 1922, varied from 0.3c. to 13c. per M cu.ft. the average for all plants being 6.5c. It is generally figured as being worth its equivalent in terms of the cheapest available substitute fuel. On the basis of steam coal at $4 per ton, and assuming the same efficiencies with coal as with gas, coke oven gas would be worth about 9c. per M. In the opinion of some of the operators, considerable amounts of the gas used in this way might be contracted for at from 10 to 15c. per M. The largest amount of gas so consumed at any one plant in 1924 would have furnished enough hydrogen to fix 30,000 tons of NH_3. Furthermore, the fixation plant could return a gas which would contain approximately 66 per cent of the heating value that was in the original coke-oven gas, so that it would only be necessary to find a substitute fuel for one-third of the gas used under boilers. In addition to this the gas that could be returned after hydrogen extraction would be a highly purified gas of high heating value—over 800 B.t.u. per cu.ft.—and might find special uses which would render it more valuable than the original coke-oven gas. If a substitute fuel were used to release all the gas burned as boiler fuel and the gas after hydrogen extraction were returned to the coke plant, then it should be possible to extract an amount of hydrogen equivalent in heating value to all the coke-oven gas fired under boilers and still satisfy all the other demands for the gas. On this basis, the above plant could supply enough hydrogen to fix annually 90,000 tons of NH_3. On this basis there were 8 coke-oven plants in the United States in 1924 burning sufficient gas under boilers to fix more than 50 tons of NH_3 per day at each plant. Assuming that this hydrogen could be obtained at a price equivalent to coal at $4 per ton as substitute fuel, it would cost about 5c. per M cu.ft.

Considerable amounts of coke-oven gas are now sold to outside consumers other than that distributed through city mains. The amount so sold in 1924 contained sufficient hydrogen to fix 85,000 tons of NH_3 or figuring on the hydrogen equivalent of this gas, as was done in the case of gas burned under boilers and which seems to be logical if the residual gas after hydrogen extraction is returned to the coke plant, three times this amount could be fixed. According to the Geological Survey statistics for 1922, the average amount received from the sales of gas was 11c. per M for the whole industry, with one large block of it selling at 4c. and the majority at 9c. As near as we have been able to ascertain from opinions obtained in 1925, from some of the operators in the Birmingham district, considerable amounts of the gas might be available at about 10c. per M. In a locality where a demand existed for a very clean gas of high heating value it might be feasible for a fixation plant to purchase coke-oven gas, extract the hydrogen and sell the surplus gas for industrial heating.

In ordinary coke-oven practice, only about 25 to 30 per cent of the hydrogen in the coal appears as free hydrogen in the gas. From the standpoint of ammonia synthesis, it is pertinent to inquire into the possibilities of increasing both the amount and concentration of the hydrogen in the gas. Assuming that coking coals contain an average of 5.0 per cent H on the dry basis, and 5.0 per cent oxygen, that the hydrogen equivalent of the oxygen is eliminated as H_2O, and taking as a basis the analysis given above for a run-of-oven gas, the following hydrogen balance per ton of coal carbonized was made:

Total net hydrogen	88.0 lb.
Free H_2 in gas	27.2 "
H as CH_4	39.1 "
H as C_2H_4	3.0 "
H as C_6H_6, etc.	2.0 "
H in the tar	5.7 "
H left in the coke	4.5 "
H in NH_3	1.0 "
Total H accounted for	82.5 "

If all the hydrogen in the hydrocarbons could be liberated by thermal decomposition the amount of hydrogen per ton of coal could be multiplied by about 2.8. Methane is the most difficult of the hydrocarbons to decompose but its decomposition is practically complete

at 1,000 deg. C., though several hundred degrees higher are required to obtain complete decomposition at a rate compatible with commercial operation. The work of Weaver [Weaver, *Chem. & Met. Eng.*, vol. 28, pp. 764; 939; 1072 (1923)] and experiments by Simmersbach [F. H. Wagner, "Coal and Coke"] indicate that 85 to 90 per cent of the hydrocarbons in coke-oven gas could be decomposed to carbon and hydrogen by heating to 1,200 deg. C. The cost of such an operation is difficult to estimate in the absence of so much of the necessary data. Weaver has published cost estimates on the production of hydrogen by the thermal decomposition of oils and his lowest estimate for a plant producing 1,650 M cu.ft. of hydrogen daily was $0.43 per M. However, this includes an item of $0.17 for fuel and the raw material for hydrogen, and is based on the production of a much purer gas than would be necessary if the gas were to be used for hydrogen extraction by low temperature methods. If only 85 to 90 per cent of the CH_4 were to be decomposed, a lower temperature could be used, resulting in a higher thermal efficiency and lower depreciation. With a moderate thermal efficiency the separated carbon should provide sufficient fuel to do the cracking even when starting with cold gas. It is also possible that the carbon might itself form a valuable byproduct and aid in reducing the cost of the production of hydrogen. A carbon for use in rubber compounding is now being produced by the high-temperature decomposition of natural gas. Assuming that coke-oven gas which has been treated for byproduct recovery in the usual way is to be thermally decomposed, and assuming that all the ethylene and 90 per cent of the methane can be decomposed and that all the CO_2 will be reduced to CO, it is estimated that 1,000 cu.ft. of coke-oven gas would yield 1,360 cu.ft. of a gas of the following composition:

H_2	84.3 per cent
CO	8.8 per cent
N_2	4.4 per cent
CH_4	2.5 per cent

Any increase in the hydrogen content would result in a material reduction in the cost of hydrogen extraction by a liquefaction process.

Having briefly reviewed the question of the availability of coke oven gas as a source of hydrogen and the possible value that might be assigned to the gas, it remains to compare the liquefaction process using coke-oven gas with the catalytic process on a cost basis. Since so many of the necessary data are lacking, this can only be done in a very approximate way, but the results should serve to show whether the liquefaction process is entirely out of the running or whether it is worthy of serious consideration. Patart [*Memoires et. Compt. rend. des Trav. de la Soc. des Ing. Civ. de France*, Bulletin of April-June (1912)] has attempted to compare the coke-oven gas liquefaction process with the water-gas catalytic process used at the Oppau plant, in such a way as to arrive at a maximum price that could be paid for coke-oven gas and still enable the liquefaction process to compete with the catalytic process. Patart's figures for the latter process are said to be based on Oppau pre-war practice. On a basis of one metric ton of fixed nitrogen for a plant with a capacity of 100 tons per day, he estimates the cost of producing the hydrogen-nitrogen mixture ready for synthesis, at $39.64. In arriving at the cost for the coke-oven gas liquefaction process, exclusive of the gas itself, he assumes:

1. That the cost of extracting hydrogen from the gas by cryogenic methods is the same as the cost of extracting nitrogen from the air for the same volumes treated.

2. That the cost of CO_2 removal, final purification and nitrogen addition are the same as for the catalytic process.

Taking the cost of nitrogen as 14.2c. per M cu.ft. he finds $37.92 as the total cost exclusive of the gas, leaving $1.72 available for paying for coke-oven gas. Assuming approximately 100 M cu.ft. of hydrogen per ton, this means that the hydrogen in the coke-oven gas can cost no more than 1.7c. per M or if the residual gas left after hydrogen extraction is valued the same as hydrogen per B.t.u., then 3c. per M is the most that could be paid for coke-oven gas. There is certainly no appreciable quantity of coke-oven gas in this country available at so low a figure. The result obtained by Patart is a small difference of much larger numbers and it is easy to change it considerably by making slightly different assumptions. For example, L'heure [*Memoires et Compt. Rend. d. Trav. Soc. Ing. Civ. de France, Bull.*, April-June, 1922] defending the Claude process, shows that by merely taking the correct figure of 78 per cent N_2 in the air instead of the approximate 80 per cent and considering coke-oven gas to contain 52 per cent H_2 instead of 50 per cent and allowing for the small amount of nitrogen that will be left in the H_2 by the liquefaction process, the price that can be paid for coke-oven gas is doubled.

We have attempted to make a rough cost comparison of the two processes under conditions that might more nearly represent present practice in this country. The basic data used in making this comparison is briefly summarized below:

1. *Investment in Plant.*—Patart gives $77 per annual ton of NH_3 as the total investment in a synthetic ammonia plant using the water-gas catalytic process for hydrogen. A figure of $350 to $500 per annual ton has been stated to be more nearly correct for American conditions (U. S. Dept. of Commerce, *Trade Information Bulletin* No. 240, Pt. III of the Nitrogen Survey, by J. M. Braham; also, Report on the Fixation and Utilization of Nitrogen, No. 2041). A recent figure obtained in this country for the cost of a blue water gas plant, compared with the figures given by Patart for the cost of the gas producer section of the Oppau plant would indicate an investment of about $100 per annual ton. Ernst [*Trans. Am. Inst. Chem. Eng.* (preprint)] gives a figure of $190 per annual ton for an ammonia plant with electrolytic hydrogen generators. For the first estimate to be given we have assumed $250 per annual ton, and for the percentage distribution among the various sections of the plant, we have used Patart's figures with the exception of the gas-generating section where we have used figures for the total cost of the gases based on recent American practice.

2. *Cost of Blue Water Gas and Producer Gas.*—After a study of figures from various sources we have chosen 20c. per M for blue water gas and 7.5c. per M for producer gas from coke.

3. *Liquefaction Costs.*—Reliable data for this item are difficult to obtain. The cost depends considerably on the size of the installation and on the cost of power. For the latter we will assume a figure of 1c. per kw.-hr.

Because of the scarcity of information on liquefaction costs, it seems worth while to go into a little more detail, and we give below a summary of some of the information on the basis of which we arrived at an approximate cost of nitrogen from the air.

(a). British Ministry of Munitions Report (Basis 1,000 cu.ft. of nitrogen for a plant of 56,000 cu.ft. per hr. capacity.)

Labor	1.06c.
Materials	0.70c.
Maintenance	0.62c.
Amortization (10 per cent)	3.80c.
Energy (9.3 kw.-hr. at 1c.)	9.30c.
Interest at 6 per cent	2.30c.
Total	17.78c.

These are presumably pre-war costs and might have to be increased somewhat for conditions at the present time. The above plant consists of two operating units and one spare, the units being one of the largest size Claude units for air separation.

(b). Estimate Based Partly on Operating Test at U. S. Nitrate Plant No. 2.

Energy, 8 kw.-hr. at 1c.	8.00c.
Labor	2.30c.
Caustic	1.60c.
Maintenance	0.71c.
Fixed charges (15 per cent on an investment of $3,700 per M cu.ft. per hr.)	6.40c.
Total	19.01c.

Figures obtained from one of the oxygen companies indicate that the investment in an air separation plant is about $3,000 per M cu.ft. of nitrogen per hour.

(c). Murray [*Trans. Faraday Soc.*, vol. 18, p. 205 (1922)] of the British Oxygen Co. gives the cost of oxygen from a 9,000 cu.ft. per hr. Claude plant as $1.09 per M. This is based on energy costing 2.7c. per kw.-hr. At 1c. the cost per M is reduced to $0.67. On the assumption of a 90 per cent oxygen recovery and 80 per cent nitrogen recovery, this corresponds to $0.20 per M for nitrogen.

A few other less complete estimates place the costs at about these same figures and it appears that 20c. per M is a fair figure for the cost of nitrogen.

Various estimates for proposed liquefaction processes for the production of cheap oxygen have placed the cost much below this estimate. For example, the report of the Bureau of Mines on "The Use of Oxygen or Oxygenated Air in Metallurgical and Allied Processes" estimates that oxygen can be produced in large plants at $3 per metric ton. On the assumption of 100 per cent yields, this is equivalent to 3c. per M for N_2.

None of these processes has as yet demonstrated by actual operation that liquefaction costs can be lowered from the present values. However, a plant of the capacity that we are considering would require about 15 units of the size of the large Claude units (9,000 cu.ft. of O_2 per hr.) and it should be possible to effect a material reduction in liquefaction costs by the use of larger units. In translating these costs into those for hydrogen from coke-oven gas, the assumption has been made that the cost of treating equal volumes of air and coke-oven gas is the same and that only 80 per cent of the N_2 in air is recovered in air-separation systems. On this basis, we have arrived at a figure of 12.6c. as the cost to treat M cu.ft. of coke-oven gas.

4. *Water Gas Catalysis.*—We have used Patart's figures largely for the operating costs in this section with some exceptions. On the assumption of 4 volumes of steam per volume of gas to the catalyst, there would be required about 25,000 lb. per ton of NH_3. By the use of steam interchangers as at Oppau [R. S. Tour, *Chem. & Met. Eng.*, vol. 26, p. 307 (1922)], practically two-thirds of this steam is recovered. We have assumed that 8,300 lb. of steam must be supplied at a cost of $0.40 per 1,000 lb. This gives a greater steam cost than in Patart's estimate presumably due to the fact that much of the steam at Oppau is byproduct steam generated from the exhaust of the gas engines, but a considerably lower cost than in the estimate based on results at U. S. Nitrate Plant No. 1.

5. *Cost of Labor and Supplies.*—Patart charges labor at 14c. per hour. In making our estimates, we have assumed Patart's estimates for the number of man-hours, but have multiplied the unit cost by 4. Furthermore, we have doubled all his estimates for supplies. Incidentally, it may be mentioned that these items are relatively unimportant in the total cost estimate.

6. *Gas Purification.*—The bulk of the CO_2 is assumed to be removed by means of water scrubbing under a pressure of 25 atm. The total amount of CO_2 to be removed in the liquefaction process is much less than in the case of the water-gas catalytic process so that the former should require a smaller scrubbing system. Nevertheless, we have assumed the same investment for both. The water requirement will be approximately the same for the two, being independent of the CO_2 concentration if we assume the validity of Henry's law. On the basis of the data given by Tour on Oppau practice it is estimated that the total energy requirement for water pumping would be about 285 kw.-hr., or with a 60 per cent recovery of energy by a water turbine, the net requirement is 113 kw.-hr. Data on the motors driving the water pumps at Oppau call for 87 kw.-hr., so that we have assumed a mean value of 100 kw.-hr. Patart allows 300 kw.-hr. as the energy requirement for the water scrubbing, but this presumably includes the energy for CO_2 compression, which we have taken care of under another item. The amount of CO to be removed will be about the same in both cases. The cost of final purification has therefore been assumed to be the same for both processes.

7. *Cost for Compression of Gases.*—The energy requirements for compression has been calculated from the ordinary expression for 3-stage compression based on ideal gases, assuming 60 per cent over-all efficiency and allowing 1.3 for the value of n in $pv^n = constant$. For the catalytic process there would be about 158,000 cu.ft. of gas from the CO converter to be compressed to 25 atm. and 100,000 cu.ft. from the CO_2 scrubbers to be compressed to 200 atm. The calculated energy for this is 1,100 kw.-hr. The compression of the coke-oven gas for the separation of hydrogen is taken care of in the liquefaction costs and we need here only to account for the compression of 100,000 cu.ft. of hydrogen and nitrogen from 1 to 200 atm. requiring about 900 kw.-hr. The total compression cost will be assumed proportional to the amount of energy used.

8. *Value of Byproduct Gas.*—After liquefaction separation of the hydrogen, there will be apparently 95,000 cu.ft. of residual gas of 830 B.t.u. This is a very high grade fuel and might find various special uses. For example, we might regard it as being utilized in gas engines for power generation. If we take 18,500 B.t.u. as being the average heat consumption of gas engines

per kw.-hr. at the switchboard, and assume that the fuel gas represents one-third of the total cost of electric power generated in this way, then to deliver power at 1c. per kw.-hr. the byproduct gas would be worth 15c. per M. If we figure the value of this gas on the basis of equivalence to coal at $4 per ton, we obtain 12.5c. per M. We might also regard it as being equivalent in value to an amount of coke-oven gas of the same heating value. On this basis it would be worth per M about $\frac{830}{560}$ times the coke oven gas per M. If the coke oven gas were to be purchased by an independent fixation plant, it would hardly be reasonable to suppose that the byproduct gas could be disposed of for more than or even as much as the coke-oven gas. On the other hand, the fixation plant would use about 3,000 kw.-hr. of electrical energy per ton of NH_3 and the generation of this would consume about two-thirds of the gas and the remaining third could possibly be utilized for steam generation. In the detailed cost estimate given below, we have been conservative on this point, and only regarded the residual gas as being worth 5c. per M.

Cost Comparison of the Two Processes on the Basis of 1 ton of NH_3.—Since this is to be mainly a comparison, and not an absolute estimate of the cost of hydrogen by either process, we have assumed 100 per cent operation and have allowed nothing for general expenses, contingencies and various other items that might reasonably be expected to be the same for both.

Table II—Water Gas Catalytic Process

(a) Gas Generation		
78,000 cu.ft. of water gas at $0.20		$15.60
39,000 cu.ft. of producer gas $0.075		2.92
3,000 cu.ft. of nitrogen at $0.20		0.60
Total		$19.12
(b) Water Gas Catalysis		
8,300 lb. of steam at $0.40 per 1,000		$3.30
Energy, 15 kw.-hr. at $0.01		0.15
Labor		0.48
Supplies		1.20
Maintenance and repairs (10 per cent of the investment)		4.07
Fixed charges (20 per cent of investment)		8.15
Total		$17.35
(c) Water Scrubbing		
Energy, 100 kw.-hr. at $0.01		$1.00
Labor		0.93
Supplies		0.27
Maintenance and repairs		1.75
Fixed charges		3.50
Total		7.45
(d) Final Purification		
Energy, 175 kw.-hr. at $0.01		$1.75
Labor		0.60
Supplies		2.00
Maintenance and repairs		2.33
Fixed charges		4.65
Total		$11.33
(e) Gas Compression		
Energy, 1,100 kw.-hr. at $0.01	$11.00	
Labor	1.55	
Supplies	0.18	
Maintenance and repairs	3.22	
Fixed charges (15 per cent)	4.85	
Total	$20.80	
Grand total		$76.05

This total represents the cost of about 100,000 cu.ft. of the purified and compressed gas ready for synthesis, so that the cost per M cu.ft. would be about $0.76.

On the above basis, the coke-oven liquefaction process is about on a parity with the water-gas catalytic process. No claim is made for any great accuracy in this estimate, and it is undoubtedly open to many criticisms; but it at least seems to show that under the assumed conditions, the liquefaction process is worthy of serious consideration.

The cost for the liquefaction process would be materially decreased by a reduction in liquefaction costs. If the cost could be reduced to that equivalent to oxygen at $3 per ton, as is claimed, the above cost for 1,000 cu.ft. of the purified gas mixture would be reduced to about 59c. An increase in the hydrogen content of the gas (48 per cent H_2 assumed in the estimate) would also materially reduce the cost. On the other hand, a decrease in the investment per annual ton favors the catalytic process and at $100 per annual ton, the above method of arriving at costs would show the catalytic process to be somewhat cheaper. An increase in cost of coke or steam favors the liquefaction process. It is also fairly evident that not much more than 10c. per M. could be paid for coke-oven gas and certainly no more if the byproduct gas could not be disposed of at 5 to 6c. per M. If the byproduct gas can be valued at a higher figure, say 10c., then 12.5c. could be paid for coke-oven gas for the liquefaction process to be on a parity with the catalytic process.

Table III—Coke Oven Gas Liquefaction Process

Coke-oven gas, 195,000 cu.ft. at $0.10	$19.50
20,000 cu.ft. of N_2 at $0.20	4.00
Liquefaction of 175,000 cu.ft. at $0.126 per M	22.00
Water scrubbing and final purification (same as in Table I)	18.78
Gas compression $\frac{900}{1100}$ × estimate under Table I	17.00
Total	$81.28
95,000 cu.ft. of byproduct gas credited at $0.05 per M	4.75
Net cost	$76.53

If we assume that hydrogen is to be extracted from the oven-heating gas, the deficit in heating value to be made up with producer gas made from coke breeze, and if we value the hydrogen on the basis of the producer gas at 5c. per M, it would be worth about 12.8c. per M. Assuming all the other items in the above cost estimate to be the same, the cost of 1,000 cu.ft. of the purified and compressed gas ready for synthesis would then be 72.5c. per M.

It is claimed by Claude [*Trans. Faraday Soc.*, vol. 18, p. 219 (1922)] that an additional advantage for the coke-oven gas process lies in the fact that a byproduct of ethylene or a gas with a very high C_2H_4 concentration may be obtained, which may be converted to ethyl alcohol. Assuming the 2.5 per cent of illuminants reported in the average run-of-oven gas from Koppers ovens to consist entirely of ethylene, and that 80 per cent of this may be recovered in a concentrated form by a liquefaction process and that an 80 per cent conversion to ethyl alcohol may be obtained, it should be possible to obtain about 0.28 gal. of alcohol per M cu.ft. of gas. This corresponds to about 32 gal. per ton of coal carbonized, which is almost as much as the crude light oil yields. The Claude plant at the Bethune mines is said to be recovering 0.31 gallons of alcohol per M cu.ft. of gas [*Chimie et Industrie*, vol. 13, p. 718 (1925).] Incidentally, the recovery of the light oils may be readily accomplished by the low-temperature process with little additional expense.

Solely as a means of getting hydrogen for ammonia synthesis, the coke-oven gas liquefaction process with present liquefaction costs does not look particularly attractive, except when coke-oven gas could be obtained for less than 10c. per M cu.ft.; but when utilized at the same time to extract the light oils and a concentrated ethylene mixture for conversion to alcohol, it appears to have some promise.

Dehydration and Distillation of Coal Tars

Some notes on British practice with reference to heat economy and modern equipment

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DEHYDRATED tar and the allied products generally known as "refined tars" and "prepared tars" are employed for a number of purposes aside from road surface treatment, purposes which chiefly take advantage of the water-proofing and inert qualities of the tar. Examples of such applications are roofing felts, coarse black paints and varnishes, and electric cable insulation. A certain amount, not very much at present, is required for liquid fuel. It is probable that a demand will shortly arise for a tar free from water, which will normally command a better price than the raw material in which water is an impurity.

The largest application in Britain, that of road surface treatment, demands not only freedom from water, but also a certain physical consistency (measured by the viscosity) and the minimum of suspended solids (free carbon), and water-soluble substances not desired in surface water (tar acids). The greater proportion of crude tars require, to conform with this specification, not only the removal of water, but also a certain proportion of oils. Hence the process of dehydration usually implies a partial distillation.

In the majority of cases the treatment accorded is heating to over 200 deg. C. It is found, of course, that the water comes away much below this point, but, after the water is gone, the tar yields very little distillate until it reaches its true boiling point, which is, in most cases, in the neighborhood of 200 deg. C.

In this connection it is instructive to calculate the thermal quantities, thus: Suppose 5 per cent of water and 3 per cent of light oil are removed at an average temperature of 110 deg. C.; that a further 5 per cent of oils is removed at an average temperature of 210 deg. C., and the final temperature of the bulk is 220 deg. C. Specific heat of tar 0.48; latent heat of oils average 80 (C. units).

In 100 kg. of tar:

	Cals.
87 kg. heated 15 to 220 deg. C. = 205 deg. C. $87 \times 0.48 \times 205$ =	8,561
5 kg. (water) heated 15 to 110 deg. C., and evaporated $5 \times (95 + 536)$ =	3,155
3 kg. (oil) heated 15 to 110 deg. C. and evaporated $3 \times (95 \times 9.45 + 80) = 368$	
5 kg. (oil) heated 15 to 210 deg. C. $5 \times (195 \times 9.45 + 80) = 839$	1,207
Cals.	12,923

The relative quantities should be noted and also the fact that the largest is the bulk heating of the tar. In dehydrating tar by the use of pot stills, this heat is almost unrecoverable, and the large quantity of tar has to be cooled for further use.

It is, of course, only ordinary good practice to utilize the two other heat quantities by condensing the distillates in coils immersed in the raw tar awaiting treatment. Adding them together it is found that 4,362 kg. cal. are available. With 80 per cent efficiency in exchange, we can get this heat to raise another 100 kg. of tar 73 deg. C.

Saving Heat in Dehydration

A modern dehydrating plant is designed to use over and above the latent heats some proportions of the sensible heat otherwise lost in the outgoing tar. This type of heat exchange can, of course, be most effectively performed in continuously operating equipment, but not all such plants employ this particular heat exchange.

A type of plant that has found great favor in Britain for maximum heat recovery is the Hird dehydrating plant. Here the tar enters a casing wherein it is heated by coils used for condensing the oil and water distillates. Leaving this in a partially heated state it passes through a heat exchanger consisting of a nest of tubes fitted in an inclosing cylindrical casing, with branches so arranged that the ingoing tar passes through the smaller passages, and the finished tar is outside them. The preheated tar is finally distilled by direct fire in a tubular still, consisting of a cast iron box with end plates of steel, in which are expanded a number of 6-in. steel tubes of ¼ in. thickness.

The still is made thus so that the main fabric is unattacked by the corrosive impurities (chiefly fixed salts of ammonia) in the tar. The heating surfaces are made of steel tubes, as such materials are most easily replaced when corroded by any cause, or deformed by overheating. The still is adapted for gas, oil or coke firing. Control is obtained by a thermometer with the bulb in the tar, which shows the finishing temperature. To regularize the tar flow, baffle plates are fitted so that the tar has a definite path to follow, visiting all portions of the still in turn. The vapors pass down the preheater coil, and any uncondensed vapors are taken care of by a final water cooled condenser. It will be appreciated from the figures given above that a point can come where the total heat in the vapors may be more than the tar can take up, up to the average condensing point of the vapors (about 100 deg. C.).

Frothing of Tar

Tar containing even small proportions of water cannot well be distilled in bulk owing to the familiar frothing trouble. This is recognized in the design of all dehydrators of the continuous type which have one common feature, i.e., only a small quantity of tar is under treatment at one time. The Hird plant contains only sufficient to cover the firing tubes by a few inches. Another type employs a coil into which tar is pumped and heated under pressure. When the pressure is released the necessary heat for distillation is provided by the superheat of the bulk. Another system employs a still having plates in the vapor space whereon the entering tar is heated by the surrounding vapors. In each case freedom from frothing is the object of design.

It has been shown that a small drop of water can be kept in suspension in a suitable liquid medium in which it is immiscible, and heated as high as 180 deg. C. before it evolves vapor. When the end comes, of course, it is a small explosion. In no case can tar be even approximately dehydrated at 100 deg. C., and quite 160 deg. C. may be taken as the minimum for practical purposes.

A steam heated dehydrator recently put on the market is the Wikner still, which has several points of interest. Tar in the casing is heated, at the surface

only, by steam at boiler pressure in steel tubes. The lack of convection prevents ebullition except at the surface. The vapors pass down coils opening into the vapor space and are condensed in the lower layers of the tar. The stratification of the various temperature layers is stable, except that the water tends to rise to the surface and thereby to separate and boil off quietly.

This still is, of course, designed primarily for continuous operation. It has one feature of value—the fact that there is no fire to maintain means that it is quite safe and independent of supervision; it may be left standing at full heat overnight and started or stopped in a few seconds. Another recommendation, of course, is the fact that the steam heating is a highly efficient process thermally, and the raising of the steam itself is much higher in efficiency than any direct fire distillation of the tar is likely to be. The combined effect is a low fuel cost per ton.

In nearly every case tar can be successfully dehydrated by steam, assuming a reasonably good pressure, say 80 to 100 lb. The production to road tar specifications will depend upon the composition of the tar. In some cases the final temperature necessary would be far beyond the powers of the steam. The Wikner plant was devised to give a preliminary treatment of tar before complete distillation. Frothing troubles are entirely eliminated, and the high temperature of the treated tar, together with its freedom from water, remove two of the loads from the fire-heated stills.

Tars for Road Use

The standard specifications for the two common classes of road tars are shown in the table. Most true coal tars can be converted into these grades by dehydration or partial distillation at suitable temperatures. The permissible variations are of course based on the available raw materials, and are in some details quite broad. They tend to exclude more than a small proportion of water gas tars and Mond gas tars. The specific gravity range permits quite light vertical retort tars to be employed, and the same is true of the tar acid figure. It is doubtful, however, whether the original objection to tar acids (extraction by rain water) will ever be wholly satisfied. It has recently been suggested that tars with a high proportion of free carbon are the more adhesive to road metal, but so far there is little evidence to support this statemen.

As indicated above, different makes of tar may cause considerably different lines of treatment to be adopted. Some of the heavier direct process coke-oven tars, such as the Otto tars, may be too heavy or viscous for the Road Board Specification even before any oil has been removed in a dehydrator. The Otto system, to take one example, is designed to condense the tar out of gas while sending forward the moisture (and therefore the ammonia) and the light oils for extraction in the rest of the plant. In practice this means that a large proportion of the naphthalene goes forward as well, and a highly vicious tar may result.

Naphthalene is mentioned here because it, more than any other, is the substance whose presence or absence makes for higher or lower viscosity. In fact there have been cases of coke-oven tars so rich in naphthalene that treatment at 290 deg. C. was necessary to bring the viscosity up to Road Board Specification No. 1.

The viscosity range appears to be numerically very wide, but actually it is found in the majority of cases that it represents only a small variation when converted

Specifications for British Road Board Tars, Nos. 1 and 2

Requirement	Tar No. 1	Tar No. 2
Specific gravity at 15 deg. C. not higher than water or ammoniacal liquor, not more than	1.225	1.240
Other distillate (light oils) below 170 deg. C., not more than	1 per cent by weight	
Distillate between 170 and 270 deg. C., (middle oils), within	12.0 –24.0 per cent by weight	10.0 –18.0 per cent by weight
Distillate between 270 and 300 deg. C. (heavy oils), within	4.0 –12.0 per cent by weight	6.0– 12.0 per cent by weight
Phenols or crude tar acids, not more than	5.0 per cent by volume	4.0 per cent by volume
Naphthalene, not more than	8.0 per cent by weight	5.0 per cent by weight
Free carbon, not more than	22.0 per cent by weight	24.0 per cent by weight
Consistency or viscosity, within the range	3.0– 20.0 seconds	20.0–100.0 seconds

on terms of the permissible temperatures to be employed in the dehydrator. The temperature control must be carefully standardized against actual results.

It may be mentioned that various prepared mixtures are often made by "softening back" pitch with tar oils. These processes must be studied as it becomes possible to extract from the tar oils, the constituents which have more than fuel value, and the whole process may at any time be more profitable than simple dehydration. This handling also permits of the admixture of bitumen, oil, pitch, etc., as demanded in a particular case.

Dehydrating Water Gas Tar

A special case for dehydration study is provided by water gas tar. This substance is an emulsion of water with light gravity tar made from petroleum oils cracked in a water gas carburetor, mixed with uncracked oil, carbon and ash dust of all grades of fineness. There is no doubt that in many cases a considerable decantation could be practiced but for the dust.

Much attention has been given to the mechanical separation of this mixture, and centrifugal machines of the high-speed type are coming into wider use. Tars of this description can be effectively distilled for dehydration in a still of suitable type by observing certain conditions. If, for example, using a Hird still, the material in the still is maintained at a sufficiently high temperature and the feed arranged so that pressure fluctuations in the still cannot affect its regularity, the area of disengagement and the vapor space are sufficient in most cases to allow of distillation without projection of liquid from the still. It should be noted in these cases (e.g., when the raw material contains 20 per cent of water or over) that the advisability of heat exchange should be considered in the light of whether it will interfere with the functioning of the dehydrating still proper. Such a proportion of water cannot in any case be condensed in the tar, and once one has reconciled oneself to the distillation of 20 to 50 per cent of water to get tar dehydrated, the relative importance of preheat to 100 deg. C. tends to diminish.

A minor point in connection with free carbon is often lost sight of. It is well known that the addition of paraffinoid or other aliphatic oils to a high temperature tar tends to precipitate free carbon, and that many tars from vertical retorts are non-aromatic in structure, but it is an unfortunate fact that the mixing of tars from various sources is liable to result in carbon deposits. This is not usually found to be important in complete distillation as the pitch receives the solids, but in making fuel mixtures and so on, a muddy deposit may be found if a quantity is kept in hot storage.

Marketing the Organic Acids

How oxalic, lactic, formic, citric and tartaric acids are distributed to a wide range of consuming industries

By Sidney D. Kirkpatrick
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OTHER groups of chemical commodities are of greater importance from the viewpoints of production and distribution, but the organic acids—particularly oxalic, lactic, formic, citric and tartaric—have certain common characteristics that have given them a well-defined position in the organization of chemical industry. Although derived from quite different raw materials by unrelated manufacturing processes, these organic acids show an interesting competitive relation in many of their important uses. Likewise, although all are widely distributed most of them find certain industrial applications for which satisfactory substitutes are not available. Foreign competition has been a determining factor in the industrial development of the organic acids. It is this characteristic that has made them of unusual market significance, peculiarly susceptible to changing conditions in international trade.

MARKETING

The organic acids form one of the oldest groups of chemical commodities, yet one that has been strangely influenced by changes both in technology and economic conditions. Synthetic processes have sometimes brought on a new competition from which no tariff wall would afford protection. Artificial control of raw materials has, in some instances, given these acids a truly international significance. And all such developments have found interesting reflection in the marketing characteristics of the group.

CHEMICAL PRODUCTS

Oxalic Acid

Now made from carbon monoxide and caustic soda, oxalic acid is of principal industrial importance as an acid rinse in laundries, in the dyeing and printing of textiles and in various bleaching and cleansing compounds.

Oxalic acid, industrially one of the most important of the synthetic organic chemicals, enters commerce in the form of a white crystalline solid corresponding to the formula: $H_2C_2O_4.2H_2O$. The usual commercial or technical grade will average over 99 per cent of oxalic acid, while the reagent of C.P. grade is characterized principally by freedom from such impurities as heavy metals or free mineral acids. Typical specifications for these grades are as follows:

Typical Specifications of Oxalic Acid

	Technical	Reagent or C.P.
Solution in H_2O	Clear....	Clear
H_2S metals	Nil.....	Nil
Cl	Trace...	.0009 per cent
SO_3	Trace ..	Nil
Heavy metals	.25 percent	.0001 per cent
Non volatiles		.0008 per cent

Consumption of oxalic acid in the United States at the present time is estimated at 6,000,000 to 8,000,000 lb. per year, depending more upon price at which it is available than upon essential uses for which there are no substitutes. In its principal use, which is as an acid rinse in commercial laundries, it is competitive with acetic and sulphuric acids, niter cake and other chemicals of lower price. Lately sodium silicofluoride and mixtures containing this compound have become the principal competitors of oxalic acid in the laundries. Oxalic acid is largely used in the bleaching and subsequent cleaning of plaited straw used in straw hats.

It was estimated in the second Annual Review Number of *Chem. & Met.* that 50 per cent of the domestic consumption of oxalic acid was by the laundries. Chemical uses, including the production of various oxalate salts, account for 20 per cent, the dyeing and printing of textiles requires 15 per cent, and bleaching compounds 5 per cent. The remaining 10 per cent is divided among miscellaneous uses. Oxalic acid is an ingredient of many metal polishes and similar patented preparations for cleansing metal and wood surfaces. It is also variously employed because of its property of removing iron and rust stains from fabrics.

New York City has long been the principal center of distribution for oxalic acid due presumably to the fact that a considerable proportion of the domestic consumption has been supplied by importers. Furthermore the chief consuming industries are largely concentrated in the eastern part of the country. The United States Tariff Commission, in 1923 in connection with its investigation of oxalic acid reported as follows on the transportation and distribution:

> The chief markets for oxalic acid, which is largely handled by brokers and jobbers, are in New York and Chicago. The freight rate from Chicago, one point of manufacture, to New York City, is 56½c. per 100 lb., and from Niagara Falls (another producing center) to New York City is 26½c. The inland and ocean freight from Rotterdam (center of Dutch industry) is about 22c. per 100 lb., which is 34.3c. less than the rate from Chicago to New York, and 4.3c. per 100 lb. less than the rate from Niagara Falls to the New York market.

Technical oxalic acid is usually shipped in kegs of 110, 112 or 180 lb. or in various sized barrels holding from 300 to 900 lb. Smaller quantities are sold in 5-, 25- and 50-lb. boxes. The German acid is quoted by importers in 850-lb. casks. There are no specific I.C.C. regulations for either the labelling or shipping of oxalic acid. Prices are quoted on a pound basis, f.o.b.

the principal centers of distribution (New York and Chicago).

As is the case with most of the organic chemicals which before the War were largely imported from Germany, the price history of oxalic acid has been characterized by violent fluctuations due to interruption in supply caused by the War, and by tariff and embargo measures. From an average level of 7 to 8c. per lb. prior to 1914, prices rose to 70c. per lb. in 1916, but shortly thereafter steadied at 40 to 45c. Since 1919, except for a temporary shortage during the third quarter of 1920 when prices again mounted to 63 to 65c., there has been a steady decline to a level of about twice the pre-war quotations. The high and low prices for the past 12 years are as follows:

Oxalic Acid Prices in Cents per Pound, f.o.b. New York

	High	Low		High	Low		High	Low
1913	8	7–1/10	1917	57	44	1921	23	12½
1914	20	7–1/10	1918	45	41	1922	17	11
1915	42	13	1919	39	22½	1923	13½	11¼
1916	70	50	1920	70	18	1924	12	09
						1925	11	10½

Present quotations are 10½ to 11½c per lb.

Few chemical commodities have had a more interesting industrial development than has oxalic acid. Its production history in this country has been influenced by radical changes both in technology and in economic and trade conditions. The tariff has played an important part of the history of this commodity, for in every tariff revision since 1909 it has been a bone of contention between the foreign and the domestic industries.

Prior to 1910 there was a single American producer, who made oxalic acid in a plant at Bradford, Pa., by fusing sawdust with caustic potash or with a mixture of caustic potash and caustic soda. This process, admittedly crude and inefficient, had previously been used in Europe, particularly in Norway, Germany and Holland. The American plant had a capacity of about 2,000,000 lb. per year, but severe foreign competition limited the output considerably, and in 1909 the domestic manufacturer sought and was successful in obtaining a protective tariff of 2 cents per lb. This was roughly a third of the American selling price at that time.

For a short while this duty tended to stem the tide of imports but it also encouraged the German industry in its efforts to develop a more efficient synthetic process. This method was the Goldschmidt or sodium formate process in which carbon monoxide is passed over caustic soda under certain definite conditions of temperature and pressure. The process is carried on in two stages—the first at comparatively low temperature and high pressure yields sodium formate. As the pressure is released and the temperature raised two molecules of sodium formate unite to form sodium oxalate and hydrogen gas is evolved. The synthetic process is so much more efficient that in spite of the tariff the foreign manufacturers were able to increase exports to the United States to well over 8,000,000 lb. in 1913 and 1914.

Congress was again petitioned to increase the duty but instead the Act of 1913 actually reduced it to 1½c. per lb. This would doubtless have marked the end of the domestic industry had not the outbreak of the War completely cut off imports. Prices trebled immediately and as it became apparent that the shortage would be long sustained, quotations mounted practically ten fold by 1916. Domestic manufacture by the sawdust process took on new life and conditions would have been unusually favorable, except for the fact that one of the chief raw materials—caustic potash—was also of German origin and soon became extremely scarce and expensive. American potash, produced from wood ashes, was substituted but for one reason or another there were large manufacturing losses and costs were proportionately higher.

Higher prices also encouraged others to go into the business. For a while a plant in the Middle West using corn cobs as a raw material was fairly successful. Other concerns began producing oxalic acid by various methods none of which, however, was able to survive subsequent competition that was to follow an important technical development. This came with the adoption of the formate process by an American chemical manufacturer who by 1917 was producing on a large scale. A fierce competition set in between the two processes in which the older and less efficient was finally forced to give way to the synthetic method. In the meantime and as a result of considerable research a Niagara Falls electrochemical manufacturer entered the field to use the formate process and has since been a prominent factor in the domestic industry.

Actual production statistics on the American industry have never been published in the Census reports, presumably because of the possibility of revealing the operations of individual manufacturers. In 1922, however, when there were four producers, the United States Tariff Commission in its "Census of Dyes and Other Synthetic Organic Chemicals" reported the production of 3,973,807 lb. Without revealing exact figures, the subsequent publications in this same series of reports indicated a decreased output in 1923, and a slight increase in 1924. It was reported that sales increased in quantity in 1924 but decreased in value due to the decline in prices.

Imports of oxalic acid entered for consumption in the United States since 1910 are shown in Table I. The wide variation in values and its effect on the duties collected are clearly shown in this tabulation. Of the imports received in 1925, Germany supplied approximately 80 per cent of the total, Holland 11 per cent, Belgium 3 per cent and the remainder came from Norway, England and Switzerland.

Paragraph 1 of the Tariff Act of 1922 established a duty of 4 per cent per lb. on oxalic acid. On petition

Table I—Imports of Oxalic Acid for Consumption, 1910–1925

Fiscal Year	Quantity (Pounds)	Value	Value per Unit of Quantity	Actual and Computed Ad Valorem Rate (Per Cent)
1910[1]	1,002,626	$61,271	$0.061	.....
1910[2]	4,832,553	279,714	.053	34.55
1911	7,053,899	363,353	.051	38.83
1912	7,077,462	351,449	.049	40.28
1913	8,046,380	402,960	.050	39.94
1914[3]	1,617,682	79,567	.049	40.66
1914[4]	7,163,170	354,216	.049	30.33
1915	4,496,679	262,422	.058	25.70
1916	522,549	166,117	.318	4.72
1917	1,183,256	527,827	.446	3.36
1918	757,553	311,290	.410	3.65
1919	456,698	154,041	.34	4.45
Calendar Yr.				
1919	651,690	183,968	.282	5.31
1920	1,789,452	604,922	.3380	4.44
1921	1,016,471	151,497	.1490	10.07
1922[5]	29,767	3,591	.1206	4.15
1922[6]	1,260,308	102,895	.0816	48.99
1923[7]	1,581,064	125,392	.0793	50.00
1924	3,135,664	177,641	.057	105.00
1925	2,569,275	117,639	.046	130.00

[1] Act of 1897, July 1, 1909 to August 5, 1909.
[2] Act of 1909, August 6, 1909 to June 30, 1910.
[3] Act of 1909, July 1, 1913 to October 3, 1913.
[4] Act of 1913, October 4, 1913 to July 30, 1914.
[5] Act of 1913, January 1, 1922 to September 21, 1922.
[6] Act of 1922, September 22, 1922 to December 31, 1922.
[7] January–June, 1923. General imports.

from a domestic manufacturer and one of the principal importers, the Tariff Commission in 1924 completed an investigation of the foreign and domestic costs of production and under the so-called flexible tariff provisions (section 315 of the Act of 1922) the President issued a proclamation on Dec. 29, 1924, increasing the duty from 4c. to 6c. per lb. This was the maximum increase permissible under the tariff provision.

Sodium formate is dutiable at 2c. per lb. under par. 83 of the Act of 1922, and while calcium oxalate is not specifically mentioned it would presumably be dutiable under par. 5 at 25 per cent ad valorem. The importation of calcium oxalate and the subsequent completion of manufacture in this country might offer a means of evading the higher duty on the finished products, if there were a sufficient cost differential to make this procedure profitable.

Lactic Acid

First developed commercially in the United States, lactic acid has become an important article in international trade due to its valuable uses in the tanning and textile industries. The highly purified edible product is also of growing industrial importance.

Lactic acid, obtained commercially by the controlled fermentation of carbohydrate material, is available in various concentrations and in the two general grades: technical and edible. Technical lactic acid is, in turn, graded as light or dark depending on its color. The usual commercial strengths of technical acid are the 22 and 44 per cent, although a special light lactic acid containing 66 per cent is sometimes sold. Manufacturers' specifications for these products are as follows:

22 per cent, light, refined. Lactic Acid content 22.25 per cent. A light reddish brown liquid with a sp. gr. at 15 deg. C. of 1.074, free from all sediment and containing not more than a trace of sulphate and heavy metals. Maximum lactic anhydride content 2 per cent.

22 per cent dark. Lactic Acid content 22.25 per cent. A darker brown liquid. Sp. Gr. 1.125. Maximum lactic anhydride content 4 per cent.

44 per cent light. Lactic Acid content 44.25 per cent. Liquid with deep reddish brown color. Sp. gr. 1.145. Maximum anhydride content 4 per cent.

The highest grade of refined lactic acid is that meeting the specifications of the United States Pharmacopoeia—the eighth, ninth and tenth revisions of this work still being observed in the trade. The U.S.P.X. product contains 85 per cent of lactic acid and has a yellowish color. Impurities, particularly butyric acid must be absent but small quantities of calcium sulphate are permissible. Edible lactic acid is also a highly refined product sold in various strengths, from a dilute 15 per cent grade to a material containing as much as 75 per cent of acid.

Technical lactic acid is shipped in 500-lb. barrels. The U.S.P. and edible grades are shipped in 100- or 120-lb. glass carboys, or in 1-gal. demijohns or in smaller bottles for medicinal use.

The present consumption of lactic acid in the United States probably does not exceed 2,000,000 lb. of 100 per cent acid per year, although this total is difficult to estimate since production statistics are not generally available. The leather industry offers the principal market for the technical grade, accounting for perhaps 90 per cent of the total consumption. Lactic acid is used in leather tanning as a substitute for the bran drench, the fermented mixture that serves to remove lime from the dehaired hides. The active constituent of the bran drench is lactic acid so that the use of the synthetic product is not only a natural substitution but one offering the additional advantage of furnishing a drench of definitely controlled composition. Lactic acid is also used in "plumping" leather, competing in this use with dilute sulphuric, hydrochloric and oxalic acids.

The dyeing and finishing of textiles, particularly in the chrome mordanting and in the application of acid dyes to wool, represents the second largest use for the technical acid.

Edible lactic acid is making considerable progress in replacing the more expensive citric and tartaric acids in food products. It is largely used in compounding various soft drinks and in certain confections such as fruit juices, bonbons, etc. It is reported that the addition of a small amount of lactic acid to beer of low-alcohol content greatly improves its quality and flavor by combining with free amines and amino acids. Other uses for the edible acid, such as in baking, are believed to be capable of considerable expansion.

A number of derivatives of lactic acid such as potassium, antimony and titanium lactates ore of some commercial importance. Lately ethyl lactate has been developed as a high-boiling solvent for nitrocellulose and is being used in increasing amounts in the manufacture of pyroxylin lacquers.

New York, Philadelphia and Boston have been the principal centers of distribution for both the domestic and foreign lactic acid. Prices for the different grades are normally quoted on a per pound basis, either f.o.b. New York, or the plant of the manufacturer. As indicative of the trend of prices over a number of years, the following quotations for the period 1895-1919 based on 100 per cent acid are of interest:

Approximate Prices of Lactic Acid—Basis 100 Per Cent

	Per Lb.		Per Lb.
1895	$0.80—$1.00	1910	$0.09—$0.20
1897	.20— .60	1914	.09— .20
1900	.16— .30	1917	.16— .30
1905	.11— .24	1919	.25— .35

Published by U. S. Tariff Commission, Tariff Information Survey, Acids of Paragraph 1 and Related Materials.

Quotations July 1, 1926, indicate the approximate value of the different grades of lactic acid:

22 per cent dark	$ .05½ to .06
22 " " light	.06½ " .07
44 " " dark	.11½ " .12
44 " " light (refined)	.13½ " .14
U.S.P. VIII (75%)	.52 " .55
U.S.P.X (85%)	.62 " .65

Lactic acid is essentially an American product since its method of manufacture as well as its principal industrial applications were first developed in the United States and later adopted in several European countries. The industry owes its inception to Charles E. Avery, whose first plant in Littleton, Mass., began production in 1881. At that time it was attempted to develop uses for calcium lactate as a substitute for cream of tartar in baking powder, but the industry was not markedly successful until about 1894 when a demand was created in the leather and textile industries for the technical grade of acid. Production increased considerably thereafter and a number of other manufacturers both in the United States and abroad entered the field. In 1917, according to the Tariff Commission, there were six producers of lactic acid with a combined output (in terms of 100 per cent acid) of 1,900,000 lb. valued at $340,000.

Lactic acid is made by the regulated fermentation of

a variety of carbohydrate materials. Molasses, from either cane or beet sugar refineries, has been the principal raw material used in this country although lately it has been displaced to a considerable extent by the use of glucose from cornstarch. For many years one lactic-acid plant used as a carbohydrate raw material the waste obtained from the manufacture of vegetable ivory buttons made from tagua nuts. Lactic acid is made in Great Britain by the fermentation of sugar, while in the large German plant at Nieder Ingelheim, the raw material is potato starch hydrolyzed to glucose by sulphuric acid.

Germany has been the principal competitor of the American industry and prior to the War was exporting more than 4,000,000 lb. per year. Of this quantity, however, less than 10 per cent was sent to the United States. The largest imports on record in this country were received in 1922 and amounted to 682,392 lb. valued at $55,027. The following table shows imports in quantity and value since 1914:

Imports of Lactic Acid, 1924-1925

Year	Quantity (pounds)	Value	Year	Quantity (pounds)	Value
1914	276,237	$30,423	1920	17,939	$6,517
1915	143,291	26,787	1921	301,784	77,342
1916	17,845	10,930	1922	682,392	55,027
1917	100	160	1923	182,320	23,792
1918	330	544	1924	251,005	23,338
1919	....	....	1925	620,805	72,758

In the Tariff Act of 1913 lactic acid was dutiable at 1½c. per lb. irrespective of strength, value or purity. In framing the Act of 1922, Congress (at the recommendation of the Tariff Commission), adopted a classification for lactic acid based on the various concentrations. This classification, together with the rates fixed by Congress is as follows:

Par. 1 * * * Lactic acid containing by weight of lactic acid less than 30 per cent, 2c. per lb.; 30 per cent or more and less than 55 per cent, 4c. per lb.; and 55 per cent or more, 9c. per lb.: *Provided*, that any lactic acid anhydride present shall be determined as lactic acid and included as such: And provided further, that the duty on lactic acid shall be not less than 25 per cent ad valorem. * * *

In spite of this duty, however, a considerable proportion of the domestic consumption has been supplied by the imported product.

Formic Acid

Of growing industrial importance, formic acid is a potential competitor of acetic, lactic and oxalic acids in certain of their uses. There was no domestic production in 1925, consumption being supplied by imports.

Formic acid, a colorless, corrosive and water-soluble liquid, is of somewhat less industrial importance than oxalic acid to which it is related through its principal manufacturing process. It is sold in water solutions in strengths varying from 25 to practically 100 per cent. The principal commercial grades are the 85 and 90 per cent products, which can be purchased in 400-lb. bbls. or in 140-lb. carboys. Interstate Commerce Commission regulations require the use of the white "Corrosive Liquid" label. The chemically pure formic acid has a specific gravity of 1.2178 and will generally conform to the following specifications:

H_2S metals	nil
Nonvolatiles	.0003%
Fe	nil
H_2SO_4	.0005%
HCl	.0008%

Formic acid is of growing industrial importance but in its principal uses it is competitive with other of the organic acids. Thus in the dyeing of wool with acid dyes it is a substitute for acetic and sulphuric acids. In the tanning of leather where it is used in deliming hides it is competitive principally with lactic acid. It has been used to some extent in the Tropics to coagulate rubber latex, although acetic acid is ordinarily used for this purpose. The manufacture of formic-acid derivatives, particularly the organic esters, is opening a new field of application. These esters are used as solvents in synthetic perfumery and for medicinal purposes.

No American Production

Domestic consumption of formic acid is probably in the neighborhood of 1,000,000 to 1,500,000 lb. per year, although this might be greatly extended if the product were available at a sufficiently low price. The American manufacturers of oxalic acid by the synthetic process are in an advantageous position to produce formic acid since it can be made directly from their intermediary product, sodium formate. So far, however, they have not found it profitable, presumably because of the comparatively low tariff on imports. There was no domestic production in 1925.

Imports of formic acid prior to the War reached a maximum in 1914 of 1,100,000 lb. valued at approximately $45,000. No imports were received during 1918 and 1919. Since that time the quantity and value of imports have been as follows:

1920	210,021	lb.	$ 46,922
1921	413,867	"	66,775
1922	124,944	"	11,219
1923	1,145,056	"	82,228
1924	1,290,637	"	106,688
1925	1,487,149	"	105,155

Prices of 85 per cent formic acid prior to 1914 were about 14 to 15c. per lb. Quotations more than doubled during the War but have declined since that time to approximately their former level. High and low prices cents per lb. f.o.b. New York, in recent years have been as follows:

Year	High,	Low,
1921	18	16
1922	19	15
1923	15	12
1924	13½	11
1925	10½	10½

Formic acid was first mentioned by name in the Tariff Act of 1913, which provided a specific duty of 1½c. per lb. The classification was not continued in the Act of 1922 and formic acid is presumably being classified in one of the general provisions at 25 per cent ad valorem.

Editor's Note: *The marketing of citric and tartaric acids will be discussed in a subsequent issue.*

Census of Rayon Manufactures

The Department of Commerce has announed that the production in the United States of rayon and related products sold under such trade names as "artificial silk," "celanese," "cellophane," etc., increased from 36,152,917 pounds in 1923 to 51,792,173 in 1925, the rate of increase being 43.3 per cent. The value of products reported by rayon manufacturers increased during the same period from $59,051,916 to $87,940,937, a gain of 48.9 per cent.

Recent Legal Decisions

Digest of typical cases decided in high courts, illustrating principles of law applied to business transactions

Device May Be Copied After Patent Has Expired

In a suit brought by the Ashton Valve Co. against Bailey, a former employee, the U. S. District Court, Northern District of California, decided that after the expiration of a patent it may be copied in every detail and the patentee may not complain of the use of the patented article. The suit arose out of the fact that after the expiration of the plaintiff's patent of a valve, the defendant manufactured a device so similar to that of the plaintiff as to deceive the ordinary purchaser. The only difference was that Bailey used his own name on his valves.

Liability of Manufacturer of Materials Later Converted Into Infringing Articles

American Stainless Steel Company brought suit against the Ludlum Steel Company for profits realized in the manufacture and sale of certain steels to cutlery manufacturers. The plaintiff alleged that the material manufactured and sold by the defendant infringed a pioneer invention covered by two patents, of which the Haynes patent was generic and the Brearley patent specific. The patent covered wrought metal articles and cutlery fashioned from "stainless steel." The U. S. District Court, Southern District of New York, held that the sales of defendant's steels within the field common to both patents for cutlery purposes, were made under circumstances which constituted the defendant a contributory infringer and liable for profits. However, the defendant was not liable for profits derived from the manufacture of valves made from stainless steel.

Unfair Competition in the Use of a Person's Own Name

The question of unfair competition in the use of personal names by rival corporations arose in the case of American Bosch Magneto Corporation vs. Bosch Radio Corporation. New York Supreme Court held that the plaintiff was entitled to protect the use of its own name as to commodities which it manufactured and those of a class which naturally included such products. The court held that it was not necessary to show wrongful intent on the part of the defendant nor instances of actual deception.

The same question arose in Andrew Jergens Co. vs. Bonded Products Corporation concerning the use of the name "Woodbury" in connection with a facial soap. The plaintiff has succeeded to the rights and privileges appertaining to a certain facial soap from John H. Woodbury, and advertised it so extensively that any soap called "Woodbury" was considered by the public to be from that source. The defendant made a soap for William A. Woodbury and called the product "Woodbury's Calamined Soap." The court held that this was unfair competition with the plaintiff, by reason of intentionally creating confusion in the mind of the public between the soap made for William A. Woodbury and that made by the plaintiff under rights obtained from John H. Woodbury.

Gans Water Softening Patents Sustained

According to a recent decision in the U. S. Circuit Court of Appeals, 6th Circuit, U. S. Patent 1,195,923, issued to Robert Gans and owned by the Permutit Company, New York, covering apparatus for softening water by the use of zeolites, was held valid. Suit was brought by the Permutit Company against Frank L. Wadham, et. al. The patent had previously been sustained in the Western District of New York, Second Circuit Court of Appeals, and Southern District of New York. In the current opinion the court regarded the work of Gans and Riedel & Co. as fundamental in the practical development of water softening by the use of zeolites, stating that "the entire commercial activities of all makers in this country have grown out of the commercial exploitation here by owners of the patent." The defense of earlier invention by others than Gans in Germany or earlier use by anyone in Germany, in the absence of publication, was rejected as of no importance in a suit upon a United States patent. The Leister German patent was rejected as a valid defense because it was ambiguous on the important point that the zeolite bed must be free and unconfined upon its upper surface.

Workman's Compensation Claims Construed

The question whether a claimant was suffering from occupational disease within the meaning of New York Workmen's Compensation Law was recently before the New York Supreme Court, Appellate Division, in the case of Sokal vs. Stein Fur Dyeing Company. This was an appeal for an award for compensation for an alleged occupational disease. The claimant was suffering from dermatitis which he contended resulted from aniline poisoning contracted during the handling and brushing of dry furs after the process of dyeing by the use of aniline dyes. Under the statute, in order to recover compensation, an employee must suffer from a disease contracted while engaged in a process involving the use of an element that will cause such disease. The court held that the employee could not recover damages as he was not poisoned by aniline while engaged in a process involving the use of aniline. He did not work in the department where aniline dyes were applied to the raw furs, but mereley handled and brushed dry furs after they were dyed.

In another action for compensation under the New York act the defendant United Textile Print Works was in the business of printing fabrics, in the process of which the material passed through large tanks filled with hot water. The plaintiff Erdberg's son, a boy of 16, was employed to run the material through a reel into the hot water. In mounting the rim of the tank in order to straighten the material in the reel the boy slipped and fell into the hot water, the scalds later causing his death. The employer claimed that the boy had been forbidden to climb on the tank and was not in the course of his employment when the accident occurred. New York Supreme Court, Appellate Division, held that compensation could be recovered, as the boy was acting within the course of his employment. On account of his low stature compared to the height of the tank it was reasonably necessary for him to mount the tank in order to do his work. His disobedience related to the manner of doing the work and did not place him outside the sphere of his employment.

On the Engineer's Book Shelf

Synthesis of Benzene Derivatives

THE SYNTHESIS OF BENZENE DERIVATIVES. By *Stanley C. Bate*, B.S.C., F.I.C. D. Van Nostrand Company, New York. 225 pp. Price $6.

Reviewed by P. H. Groggins

Owing to the rapid development of the dyestuff industry in this country, there has been a demand for a reliable and practical volume on the underlying unit processes of aromatic syntheses. The paucity of the literature dealing with such subjects has been recognized generally.

"The Synthesis of Benzene Derivatives" has in a large measure filled this gap and has made available in short and concise form the various methods of preparing aromatic compounds. In confining himself to the synthesis of benzene derivatives which exhibit a more or less definite regularity of transformation under treatment, the author has been able to classify his material into what amounts to unit operations.

The thorough fashion in which the material is presented can be realized from an outline of Chapters II and III on the preparation of nitro compounds and primary amines, respectively. The preparation of nitro compounds is accomplished as follows:

(1) By the action of nitric acid, (2) by the action of nitrogen peroxide, (3) by the action of nitrosyl sulphuric acid, (4) from the corresponding amine via the nitroso compound, (5) from the corresponding amine via the diazo compound.

In the elaboration of the first and most important process, examples of the following general groups are presented: Nitration of hydrocarbons, halogen compounds, amines, phenols, aldehydes, carboxylic acids and sulphonic acids.

The methods used for the preparation of primary amines are the following: (1) The reduction of nitro compounds, (2) the treatment of compounds containing halogen atoms or oxy groups with ammonia, (3) the treatment of compounds containing a labile nitro group with ammonia, (4) from amides by the action of hypochlorite, (5) by intra-molecular rearrangement of such compounds as secondary and tertiary amines, hydrazo benzenes, and hydroxylamine derivatives, (6) the direct introduction of the amino group by means of hydroxylamine, (7) the reduction of nitriles.

In the development of the first class, numerous examples of eight specific methods are given: (a) Use of iron in the presence of water and with the addition of a small quantity of acid, sulphur dioxide, salt, etc., (b) stannous chloride, (c) alkali sulphides, (d) ferrous sulphate in alkaline solution, (e) sodium hydrosulphite in alkaline solution, (f) sodium amalgam, (g) hydrogen working with a catalyst, (h) red phosphorous and iodine.

The ensuing chapters discuss in similar fashion the usual benzenoid derivatives. A chapter presenting the reactions of the diazo compounds logically follows the treatment of amines. The concluding chapter on the triphenylmethane group could be omitted without in any way decreasing the value of the book.

Some of the operating recipes used as illustrations are not of the most practical nature (p. 24 *p*-nitroacetanilid) but some pages contain very valuable information which may lead to remunerative investigation.

The incorporation of such a large number of detailed processes makes the use of this book as a text of questionable value. It is doubtful whether many students would be able to digest more than a small part of the very valuable information it contains. Its use as a guide and reference book will be appreciated by all chemists interested in synthetic organic chemistry.

The volume is very readable and is logically arranged. The frequent use of bold face type for subheadings materially assists one in grasping its contents. A little more consideration as to the quality of the paper would be appreciated.

The book is a very distinct contribution and the author is to be complimented on the thorough manner in which he has presented his subject matter.

Modern Drying Machinery

MODERN DRYING MACHINERY. By *H. B. Cronshaw*. The Chemical Engineering Library, Second Series. Ernest Benn, Ltd., London. 160 pp. Price 6s.

Reviewed by W. L. McCabe

Drying is one of the most important unit processes of chemical engineering. It is a process carried out in a diverse range of industries and applied to a large number of materials that differ widely in physical properties. It is not surprising that a great variety of drying machinery has been developed. The author of this volume has succeeded very well in classifying the large number of dryer types into a few groups and has used his classification as a basis for an excellent descriptive treatment of drying apparatus.

Although there is a short preliminary discussion of the mechanism of drying phenomena and the factors influencing the rate of drying, this discussion is entirely qualitative.

The Tragedy of Waste

THE TRAGEDY OF WASTE. By *Stuart Chase*. The Macmillan Company, New York. 296 pp. Price $2.50.

Reviewed by H. C. Parmelee

Ever since Hoover focused attention on industrial waste through the investigations of the Federated American Engineering Societies, the subject has attracted numerous authors. Fact and fancy have been mingled indiscriminately. Criticism has not always been supported by proposed remedies nor has distinction always been made between apparent extravagance and economic waste.

The present volume is a speculative and philosophic study of waste predicated on conditions that might obtain if society were organized on a functional rather

than on its present acquisitive basis. For purposes of comparison the author reviews the control of industrial production established during the World War and cites the economies enforced by various bureaus and boards. He points out that despite depleted man-power our industrial output increased 25 to 30 per cent over the pre-war period by reason of the more complete utilization of our resources and the more efficient operation of our facilities. With the end of the War we reverted to the wasteful, competitive, uncontrolled methods of production and distribution.

The elements of industrial waste are dramatized by taking an airplane view of industry through the eyes of a hypothetical Industrial General Staff charged with the duty of co-ordinating and correlating the industrial activities of the nation with a view to producing commodities primarily to meet human needs rather than to make profits. Such a General Staff would survey human requirements, raw supplies, productive capacity and man-power, and co-ordinate them in the most efficient manner based upon a functional conception of industry. The airplane view would reveal four main channels of waste in supplying human wants: Wastes in consumption, or "illth" as opposed to wealth; idle man-power; wastes in the technique of production and distribution; and waste of natural resources.

In his discussion of wastes in consumption, or "illth," the author tears the mask off of many of our activities such as the drug traffic, patent medicine trade, adulteration of commodities, quackery, speculation and gambling, luxuries and fashions. He finds a tremendous waste in advertising, but puts his stamp of approval on the dissemination of knowledge as to new inventions, new products, new processes, etc. Idle man-power due to various causes he estimates at 6,000,000 workers on any given working day. Wastes in production and distribution cannot be measured quantitatively, but are shown to bulk large under present conditions. As to natural resources he points out the appalling waste in coal, water power, oil, natural gas, lumber, etc.

Due to lack of constructive suggestions and remedies, one reads the volume with a sense of being inextricably caught in a relentless machine; and the final chapter is reached to find the author equally oppressed with his airplane view. The curtain falls on his tragedy with the villain holding the center of the stage and no hero coming to the rescue. If the book serves a useful purpose it is in cataloging and presenting waste in its worst aspects, leaving to individual initiative the problem of eliminating it here and there.

Problems in Organic Chemistry

PROBLEMS IN ORGANIC CHEMISTRY. By *H. W. Underwood, Jr.*, instructor in organic chemistry in the Massachusetts Institute of Technology. McGraw-Hill Book Company, Inc., New York. 233 pp. Price $2.

Reviewed by C. S. Marvel

The author has collected a series of study questions and problems for students of organic chemistry in a book which is divided into 24 chapters. The first two chapters deal with definitions and laboratory manipulations and the remainder covers the various homologous series of organic compounds from the simple hydrocarbons to the complex heterocyclic rings, proteins and carbohydrates. Each chapter has a few introductory paragraphs emphasizing the more important facts concerning the series of compounds covered. Excellent charts are included and these show diagramatically the principal reactions of each homologous series.

The book is not intended to take the place of a text. It will be a useful supplement to a textbook or to a series of lectures in organic chemistry. It should also fulfill the author's hope that "it may be useful to more advanced students who wish to review the subject."

Centrifugal Dryers and Separators

CENTRIFUGAL DRYERS AND SEPARATORS. By *Eustace C. Alliott.* The Chemical Engineering Library, Second Series. Ernest Benn, Ltd., London. 152 pp. Price 6s.

Reviewed by W. L. McCabe

This small but complete book gives for the first time in English a complete treatment of equipment utilizing centrifugal force for the separation of liquids from solids or immiscible liquids of different densities, and at the same time presents the theory and basic data pertaining to this type of equipment.

Two features of Alliott's treatment of his subject stand out. In the first place the book is very well balanced. Theory, constructional details, empirical data, and explicit operating information are all well covered. In the second place the remarkably diverse field of usefulness of such machinery is emphasized. One finds mention of centrifugal application to laundries and textile mills, dairies, sugar mills, heavy chemical plants, sewage disposal and other industries and processes.

Trade-Mark Profits and Protection

TRADE-MARK PROFITS AND PROTECTION. By *Harry A. Toulmin, Jr.*, of the firm of Toulmin and Toulmin and member of the bar of the Supreme Court of the United States. D. Van Nostrand Company, New York. 258 pp. Price $4.

The trade mark is to marketing what the patent is to production; but unfortunately marketing considerations have not in the past received the serious attention they deserve. Mr. Toulman has produced a book that contains the essential information about trade-mark protection, trade mark selection, and the relation of the trade mark to marketing problems, both domestic and foreign. The law is stated and illustrated clearly, interestingly and in terms of well-known examples. The importance of full preliminary investigation, and the common pitfalls of selection are treated in detail. A classified appendix, which forms the greater part of the book, serves as a ready reference to the trade-mark law.

Qualitative Analysis

QUALITATIVE ANALYSIS. By *William C. Cooper*, professor of chemistry, De Paul University, Chicago. World Book Company, Yonkers. 142 pp. Price $1.52.

This manual of qualitative analysis is intended for use in school and college, and as such is suitable for introductory courses. The experimental directions are given in great detail, perhaps to the possible stifling of the student's initiative; but in clarity of expression the book ranks high.

Boosting Flame Temperatures

Equipment for the joint working of combustion flames and electric arcs has been patented by George T. Southgate (U. S. Patent No. 1,587,197 issued June 1, 1926). The preliminary developmental work of this method of boost fuel flame temperatures was described in *Chem. & Met.*, vol. 31, p. 16 (1924).

Readers' Views and Comments

An Open Forum

The editors invite discussion of articles and editorials or other topics of interest

Corrosion Theories and Facts

To the Editor of Chem. & Met.:

Sir—I have read with especial interest an article by Pierce D. Schenck, entitled "Corrosion Theories and Facts" which appeared in the June, 1926, issue of *Chem. & Met.* It brings forth in concise and clear form the essentials of what is probably the most troublesome of all problems which meet the chemical engineer in his work with new processes or with the revamping of old processes. The effect of process materials on the equipment can be the factor which makes for success or failure in a given operation. Often a manufacture, commercially successful in every other way, goes into the "red ink" because of the high repair cost caused by corrosion of equipment. With this in mind, corrosion data *applicable in practice* are vital to the chemical engineer in his process work. This has been recognized, and numerous scientific and technical bodies have committees on the correlation of corrosion data, in order to make the information more available. I do not question the value of this work in any way; but I do want to add that my experience with corrosion data has to a great extent paralleled that of Mr. Schenck, and he has met similar difficulties. For example, a few years ago, when actively engaged in the development of processes for the manufacture of maleic acid by the catalytic vapor-phase oxidation of benzene and the later conversion of the maleic acid to malic acid, some of the serious problems to be solved in all parts of the processes were materials of construction that would resist the corrosive action of maleic acid. This acid acts exceedingly rapidly on all of the common metals; in fact, silver, gold and the platinum group are the only elementary metals which resist the action of aqueous maleic acid either cold or hot. As in the conversion of maleic acid to malic acid, it is necessary to heat the aqueous solution of maleic acid under pressure to around 180 deg. C., a satisfactory material was vital. At first, silica liners were used in steel autoclaves; but the results were not satisfactory. Finally, after an exhaustive search of the alloys, an aluminum bronze was found which met the necessary conditions and satisfactorily resisted the action of dilute or concentrated solutions of maleic acid at the necessary temperatures and pressures.

However, when this same bronze was used in another operation at room temperature with aqueous solutions of maleic acid, *but with air present*, corrosion was extremely rapid and the metal parts absolutely unsatisfactory for the purpose. Such a radical difference—a few months life in cold solutions with air present, and many years indicated life at much higher temperatures with the exclusion of air—was indeed surprising and hardly to be predicted. The experience with the cold aerated solutions might well have prevented even trials for the other higher temperature use, when the results actually obtained were so favorable.

It therefore seems certain to me that no series of comparative corrosion tests on metals and alloys when performed under a single standard set of conditions can give the chemical engineer the information he needs, and further, that in the absence of proper interpretation, the results may in many cases be extremely misleading.

A large literature of corrosion data is being built up and in the correlation of this data it is essential that the test conditions on the various materials be of a broad enough range to cover the more important conditions of use found in industry. Generalizations must be avoided if the information is to be of the most practical value and emphasis must be placed on the fact that all of the so-called standard tests which are and will be developed can serve as a rough index or guide and that the final selection must be based on works tests, if these are practical, or better, on laboratory tests under controlled conditions, making sure, however, that the conditions faithfully duplicate the actual service conditions of practical use. J. M. WEISS.

Weiss & Downs,
New York City.

Automatic Control of Fractionation

To the Editor of Chem. & Met.:

Sir—In your May issue there is an article entitled "Chemical Engineering Applications in an Oil Refinery" in which the statement is made that "the control of fractionation is by Tycos temperature regulating devices." As we had supplied the Pierce Petroleum Corporation with the temperature controllers for their fractionating tower installation at the Sand Springs Refinery, we believe this to be a mistake and have since had it confirmed by our representative in Oklahoma. Will you kindly make the necessary correction in your next issue? C. J. TAGLIABUE MFG. CO.

Brooklyn, N. Y. W. C. Begeebing,
Division Sales Manager.

Metallic Zinc Powder As a Paint Pigment

The use of zinc dust as a paint pigment is by no means a new and untried application. Records show that its use in Europe dates from 1840, and at present it is popular industrially in France, Belgium and western Germany. Practical tests by H. A. Nelson and W. A. McKim of the New Jersey Zinc Co. have led to the following conclusions:

1. As a rust inhibitive metal primer it is at least equal to any other high-grade commercial primer. Ordinary finish coat paints adhere to it and give the maximum of service.

2. Its peculiar property is that although the surface is hard enough to shed dirt readily, the film maintains its distensibility over long periods of time. This property makes zinc dust especially useful in repainting over old paint that is badly cracked and must be firmly held in place.

3. The same properties make it an excellent primer for refractory woods, galvanized iron, sheet zinc and other surfaces that usually cause painting troubles due to poor adherence.

4. The optimum amount of zinc oxide to use with zinc dust for ordinary painting purposes is 10 per cent to 25 per cent by weight of the pigment. For priming iron and steel, about 20 per cent zinc oxide is recommended.

5. This paint costs considerably less than red lead paint.

Recent Articles in Technical Periodical Literature

Vulcanizing Rubber. In the later stages of vulcanization there is a vigorous exothermic reaction. Under suitable conditions, it may cause a temperature rise of as much as 150 deg. C. above the curing temperature. Accelerators cause the reaction to set in at a lower temperature, so that the final temperature is not as high. High resin content retards the start, but not the extent, of the reaction. Alfred A. Perks, *J. Soc. Chem. Ind.*, May 21, pp. 142-9T.

Graphite in Lubricating Oil. The lubricating power of an oil on metal is directly proportional to the heat of wetting of the metal surface by the oil. Colloidal graphite increases lubricating power by forming on the metal surface a graphite layer which adsorbs a film of oil, forming a tenaciously adhesive lubricating film. W. Bachmann, *Zeitschr. angew. Chem.*, May 20, pp. 622-3.

Dangerous Gases. Safety precautions in the packing, storage, use and transportation of toxic, flammable and explosive gases; shipping rules in England. H. J. Phillips, *Ind. Chemist*, May, pp. 197-200.

Acetone. High yields are claimed for a fermentation process, in use on a large scale in Hungary, for making acetone and ethyl alcohol from maize, rice or other carbohydrate-bearing materials. In Italy, acetone and organic acids (lactic, butyric and acetic) are being produced by fermentation of sugar beets or their residues. W. G. Cass, *Ind. Chemist*, May, pp. 200-1.

Catalysis. Catalytic processes are reviewed as applied to oxidation, hydrolysis, dehydration, hydrogenation and dehydrogenation, halogenation and nitrogen fixation. Promoters for various catalytic processes are listed. Hartland Seymour, *Ind. Chemist*, May, pp. 226-7.

Chrome Tanning. Theoretically, the optimum pH for chrome tanning should coincide with the isoelectric point of the hide proteins; but a practical limit is imposed by the fact that these proteins have isoelectric points so far on the alkaline side that the Cr salts would be precipitated. Therefore, chrome tanning should be carried out in a liquor as near neutrality as possible without precipitation. S. Hilpert and E. Schlumberger, *Zeitschr. angew, Chem.*, May 27, pp. 637-40.

Electric Lamps. Introduction of lead-free glass led to methods of continuous operation. This involved development of automatic machinery, so that manual labor is being reduced to a minimum and new employees can be trained in a few days. Tungsten, the other principal raw material after glass, has been so thoroughly studied that its crystallization can be controlled for the making of filaments. H. Pohl, *Zeitschr. angew. Chem.*, May 27, pp. 653-4.

Chemical Plant Equipment. A retort for HCl; a bisulphate kettle; automatic plant for making HCl from NaCl; a crystallizer; an acid pump (plunger type); equipment for making Na_2S and CS_2. These items are illustrated and described. *Zeitschr. angew. Chem.*, Chem. Apparatus Section, May 27, pp. 45-9.

Acid and Sludge Pump. An acid-proof centrifugal pump, having no stuffing boxes. The acid-resisting material of the pump is a ferro-silicon alloy. Hard rubber pumps without stuffing boxes are also successful. Illustrated. *Zeitschr. angew. Chem.*, Chem. Apparatus Section, May 27, pp. 51-2.

Refining Glycerin. Glycerin liquors from the Twitchell process, being fairly pure, are relatively easy to refine. In refining liquors from ordinary soap making, the process is sometimes complicated by fermented fats, e.g. dark grease and sometimes the African palm oils, which yield very little glycerin. The processes of evaporation, precipitation with lime, decolorization and final purification are discussed. O. Hausamann, *Chem.-Ztg.*, May 22, pp. 369-71.

Canadian Motor Fuels. Production and consumption, in the Dominion, of gasoline, kerosene and blended motor fuels containing benzol, alcohol, naphthalene, etc. Probable future sources of motor fuels are discussed under the headings of petroleum, shales, tar sands, coal-tar oils, liquefaction of coal, denatured alcohol, acetylene and its products, and synthetic fuels from hydrogenation of CO. The relation of compression efficiencies and anti-knock reagents to the fuel problem is duly considered. R. E. Gilmore, *Can. Chem. & Met.*, May, pp. 116-9; June, pp. 140-4.

High-Pressure Technique. The main purposes of high pressure in modern industrial gas reactions are to increase reaction rate, alter equilibrium, influence the course of reaction or to facilitate heat transfer and other thermal changes. An incidental advantage is the much smaller volume occupied by highly compressed gases. Details of methods and equipment for controlling and measuring pressure and temperature in such reactions as ammonia synthesis and hydrogenation are described and illustrated. E. B. Maxted, *J. Soc. Chem. Ind.*, May 28, pp. 366-70.

Marine Plants. The harvesting and processing of algae and other marine plants has grown into an industry of considerable magnitude, both in America and Europe. Photographs are shown of various useful marine plant forms, and of the operations of harvesting, drying, leaching, grinding, iodine extraction and making sodium alginate. The principal useful products are potash, iodine and bromine and their compounds, algin and its derivatives, and products of destructive distillation of the dried plants. Maurice Deschiens, *Chim. et Ind.*, May, pp. 675-98.

French-German Potash Agreement. A discussion of the terms and conditions of the Lugano Agreement of May 1, 1926, and its probable benefits to the French potash interests. Paul Maquenne, *Chim. et Ind.*, May, pp. 821-4.

Oxygen Production. A modern installation for producing oxygen by the liquid air method is illustrated and described. Factors essential to efficient and profitable operation of the plant are discussed. Georg Illert, *Chem.-Ztg.*, May 26, pp. 377-9.

Blacks. Equipment and methods for production of lampblack, carbon black, gas black and the like are described and illustrated. Hans Hadert, *Chem.-Ztg.*, May 26, pp. 379-82; June 16, pp. 434-5.

Boiler Performance. Effect of amount and distribution of air supply, and of boiler surface and other factors on thermal efficiency in generating and using steam. W. Graulich, *Chem.-Ztg.*, June 16, pp. 433-4.

Agglutination of Coking Coals. Agglutinating power should always be measured before coking a coal; if it is low, it should be raised by blending. Medium grades may be coked alone for some uses; high agglutinating coals should be used only for particularly high-grade special cokes. A proposed standard method of measuring agglutinating power is described in detail. Such a standard method should be adopted by all producers. M. Barash, *J. Soc. Chem. Ind.*, June 4, pp. 151-60T.

Grinding. An account of the recent researches on fine grinding carried out in 1923-5 by the British Portland Cement Assoc'n. The absolute efficiency of grinding machines is one of the chief topics. Several laws of grinding are formulated. Illustrated with curves. Geoffrey Martin, *J. Soc. Chem. Ind.*, June 4, pp. 160-3T.

Saccharin Byproducts. In the last few years the chief byproducts in sacharin manufacture (p-toluenesulphochloride and the sulphonic acid and its amide) have been turned to profitable use in the making of artificial resins. The phenolic resins, for example, are improved by esterificarion with these compounds. So also are the resin acids of natural resins, such as rosin. Some aliphatic esters of the sulphonic acid are useful as plasticizing agents for cellulose esters. References are cited. Walther Herzog, *Kunststoffe*, June, pp. **105-7.**

Aerosols in Industry. The properties of smokes, fumes, clouds, fine dusts and sprays are important in industry in connection with cause and prevention of dust explosions, and with the health and occupational hazards of workers. The occurrence and treatment of such disperse systems in industrial operations are discussed. W. E. Gibbs, *J. Soc. Chem. Ind.*, June 18, pp. 177-82T.

Filtration by Centrifuging. In clarifying certain liquids, such as lacquers and oils, the centrifuge is often prefer-

able to the filter press. It gives more complete separation, with small loss, and requires little care, space and power. K. Wurth, *Chem.-Ztg.*, June 5, p. 411.

Lubricants. Heavy oils distilled from Bergius process tars yield, by hydrogenation, viscous oils having excellent lubricating properties. Like oils can also be obtained directly from coal as one of the products of berginization. Fuel oils are also formed, and considerable commercial success is anticipated in the production of these oils. A. Spilker, *Zeitschr. angew. Chem.*, June 3, pp. 686-7.

Baking. The importance of fermentation processes in the baking industries is stressed. Lactic, butyric and acetic acid fermentations are discussed as they relate to the making of bread and of cakes, jams, icings, etc. Illustrated. David Ellis, *Ind. Chemist*, June, pp. 249-51.

Electrochemical Industry. Illustrated description of the works of the Pomilio Co. at Naples. Chlorine is produced and used in making cellulose pulp. Several new uses for electrolytic chlorine are suggested, e.g., in sugar refining, petroleum refining, detinning, etc. John B. C. Kershaw, *Ind. Chemist*, June, pp. 261-5.

Chemical Glassware. Composition and properties of some of the chemical resistance and low expansion glasses which were brought out during or after the war. H. V. Renn, *Ind. Chemist*, June, pp. 270-3.

High Compression Without Knocking. A new piston design permits operation of gasoline motors at high compression without the use of any anti-knock agent. A principal feature of the design is an arrangement for lateral ignition. The practical limit of compression may be reached without knocking. P. Dumanois, *Compt. rend.*, June 7, pp. 1378-9.

Heating by Oil Circulation. Oil circulation systems applied to high-temperature heating. A review of methods employed and of heat transfer data. Th. Hoffmann, *Chem. Apparatur*, vol. 13, pp. 115-8.

Oil Shale Industry. Description of commercial installations in Estland for distillation of oil from oil shale. P. N. Kogermann, *Brennstoff-Chemie*, vol. 7, pp. 173-6.

Motor Fuel. Continuous experimentation with a 500-hp. Diesel engine has demonstrated that oil rich in phenol and similar compounds can be used to advantage. The higher oxygen content of the fuel results in a thermal efficiency somewhat lower than for straight hydrocarbon oils. The phenols do not, however, give increased corrosion of the engine parts or gum formation. A. Spilker. *Brennstoff-Chemie*, vol. 7, pp. 170-3.

Power. A lecture on "Coal and Electricity" by Sir Arthur Duckham, *Chem. & Ind.*, vol. 45, pp. 396-8 (cont.).

Refractories. Manufacture of refractories, their chemical composition and quality. J. Dautrebande. *Rev. Chim. Ind.*, vol. 35 pp. 146-9.

Acid-Resistant Iron. Application of acid-resistant iron as a material of construction is discussed (Cont.). Th. Hoffmann, *Chem. Apparatur*, vol. 13, pp. 103-6.

Materials of Construction. The use of aluminum as a material of construction in the chemical industry. Reports from various industrial concerns. Anon, *Der Apparatebau*, vol. 38, pp. 113-7. Iron as a material of construction in the chemical industry. W. Denecke and T. Meierling, *Der Apparateban*, vol. 38, pp. 98-103.

Pumping of Acids. Description of a new turbine pump constructed of high-silicon iron without packing boxes and especially adapted for the handling of strong mineral acids. W. Meinecke, *Chem. Apparatur*, vol. 13, pp. 114-5.

Magnetic Separation. Review and discussion of machinery used in magnetic separation. B. I. Rolling, *Chem. & Ind.*, 1926, vol. 45, pp. 344-6; 352-6.

Lacquers and Varnishes. Progress in the field of lacquers, varnishes and driers. M. Bottler, *Kuntstoffe*, vol. 16, pp. 101-3.

Fertilizers. Role played by fertilizers in the world chemical commerce. Anon, *Die Chemische Industrie*, vol. 49, pp. 382-3. Advertising by means of price reduction and creation of new fertilizers. Dr. Bueb, *Die Chemische Industrie*, vol. 49, pp. 410-2.

Rubber. Note on the commoner mineral ingredients for rubber. The character of the influence of various mineral compounding ingredients on the characteristics of vulcanized rubber. D. F. Twiss and E. A. Murphy, *Chem. & Ind.*, 1926, vol. 45, pp. 121-3T.

Government Publications

Prices indicated are charged by Superintendent of Documents, Washington, D. C., for pamphlets. Send cash or money order; stamps and personal checks not accepted. When no price is indicated, pamphlet is free.

Some Characteristics of Quenching Curves, by H. J. French and O. Z. Klopach. Bureau of Standards, Technologic Paper 313. 10 cents.

Nondestructive Testing of Wire Hoisting Rope by Magnetic Analysis, by R. L. Sanford. Bureau of Standards, Technologic Paper 315. 10 cents.

Measurements on the Thermal Expansion of Fused Silica, by Wilmer Souder and Peter Hidnert. Bureau of Standards, Scientific Paper 524. 10 cents.

Methods of Testing High-Pressure Natural-Gas Lines for Leakage Losses, by E. L. Rawlins. Bureau of Mines Serial No. 2752.

The Quicksilver Situation from a Domestic Standpoint, by J. W. Furness and R. M. Santmyers. Bureau of Mines Circular No. 6007.

Gas Mask for Protection Against Ammonia Gas, by A. C. Fieldner, S. H. Katz, and H. W. Frevert. Bureau of Mines Serial No. 2750.

Mineral Production Statistics for 1924—Separate pamphlets from Bureau of Mines on: Iron Ore, Pig Iron and Steel, by Ernest F. Burchard and Hubert W. Davis, 5 cents; Gold, Silver, Copper, Lead, and Zinc in Montana, by C. N. Gerry, 5 cents; Gold, Silver, Copper, Lead and Zinc in Idaho and Washington, by C. N. Gerry, 5 cents; Rare Metals—Cobalt, Molybdenum, Nickel, Tantalum, Titanium, Tungsten, Radium, Uranium, and Vanadium, by Frank L. Hess, 5 cents; Copper, by Helena M. Meyer, 10 cents; Lime, by G. F. Loughlin and A. T. Coons, 5 cents; Talc and Soapstone, by L. M. Prindle and B. H. Stoddard, 5 cents.

Mineral Statistics for 1925—Preliminary estimates in mimeographed form from Bureau of Mines on: Increased Production of Phosphate Rock; The Iron Industry; Production of Feldspar; Production of Natural Sodium Compounds and Borates; Production of Graphite; Asphalt Sales Increase.

Production Statistics from 1925 Census of Manufactures in preliminary mimeographed form for: Cork Products; Linseed Oil, Cake, and Meal; Sand-Lime Brick; Manufactured Fuel; Cane-Sugar Refining; Crucibles.

Potash Investigations in 1924, by W. B. Lang. U. S. Geological Survey Bulletin 785-B. 5 cents.

Sole Leather: World Production and International Trade, by J. Schinitzer. Bureau of Foreign and Domestic Commerce, Trade Information Bulletin No. 401. 10 cents.

Paper and Paper Products in Central America, by J. W. Vander Laan. Bureau of Foreign and Domestic Commerce, Trade Information Bulletin No. 414. 10 cents.

Latvian Timber Resources and Trade, by C. J. Mayer. Bureau of Foreign and Domestic Commerce, Trade Information Bulletin No. 408. 10 cents.

Instructions for the Operation, Care, and Repair of Storage Batteries. Navy Department, Bureau of Engineering, (Reprint of Chapter 28 of the Manual of Engineering Instructions). 15 cents.

Statistics of Universities, Colleges and Professional Schools 1923-24, by Frank M. Phillips. Bureau of Education, Bulletin, 1925, No. 45. 25 cents.

Grinding Wheels. Department of Commerce, Simplified Practice Recommendation 45. 10 cents.

Pure Zinc at Normal and Elevated Temperatures, by John R. Freeman, Jr., Frederick Sillers, Jr., and Paul F. Brandt. Bureau of Standards, Scientific Paper 522. 15 cents.

Technical Association Papers

The ninth series of papers and addresses presented before the Technical Association of the Pulp and Paper Industry was published in June. Fifty-two technical papers are included in the series and a Bibliography of Papermaking for 1925, by Clarence J. West and A. Papineau-Couture, is appended. Copies of the reprint are obtainable from the secretary, 18 E. 41 St., New York, at $3.

The Plant Notebook

An Exchange for Operating Men

Screening Pasty Materials With Rotary Screens

Materials of a pasty nature are not readily handled by screens of the type in which rotary brushes are used for aiding the screening process. This difficulty can be overcome by removing the brushes and substituting for them stationary wooden strips with the edges parallel to the length of screen and sufficiently close to it to aid in pushing the material through. In using these, arrangements should be made so that the clearance between the strip and the screen is adjustable. The grain of the wood should be perpendicular to the screen, as the wear will be much longer with that arrangement.

Colored Lights to Insure Uniform Production

In a certain manufacturing company where the product is produced by standardized unit operations it is found that in some departments a considerable saving of time and an increase in the quality of the product results from scientifically timed control.

One of these operations is the milling of a plastic. In this case a product of varying properties results from variations in the order of addition of the different constituents and in the time of working. Large quantities of a uniform product are required but each single mill handles only a few hundred pounds at one time.

In order to insure uniformity of product control has been established by means of a system of lights operated by the technical supervisor. This system controls about one hundred mills, each mill operator having four colored lights for his guidance. The red light signifies time to begin loading, the green light signifies time to begin milling, the white light signifies five minutes before the completion of the run and the blue light signifies stop mill and unload. Each particular operation as indicated by the appropriate light is to continue only while that light is burning. Slack time is done away with and, except in the case of emergency, absolutely uniform treatment is given to each bath.

As an added precaution, a control laboratory checks the quality of the product from each mill. Results of tests are sent to the technical supervisor within a few minutes of the time that samples are received. In this way it is possible to make such modifications as are needed from time to time in the procedure in order that the uniformity of the product may be maintained.

Indicating Liquid Level Accurately

A more acurate indication of liquid level in storage tanks can be obtained by the use of a cyclometer than by the ordinary float indicators often used. The use of such a device requires only slight modifications from the arrangement for the ordinary column indicator. To the shaft of the small pulley wheel over which the rope or chain from the float to the weight passes, a large pulley is fastened. From this pulley a belt is run to a small pulley located at the control point where the valves are operated. On the same shaft with this small pulley wheel a second large pulley belted to a third small pulley on an adjacent shaft, can be located if the accuracy of indication requires a further step-up of motion. Revolutions of this last shaft are indicated by cyclometer, the dial of which can be easily calibrated to read in feet and inches of liquid level. By means of the magnification of motion obtained through the pulleys and belts, a small change in level will record a large change in reading of the cyclometer and accurate control is thus made possible.

Sight Boxes From Vapor-Proof Lamp Globes

In many chemical industries, particularly those employing distillation, it is common practice to provide glass gage boxes as a visual means of controlling operations. These devices vary from the glass bell-jars used in the alcohol industry to the vapor-tight metal and glass tail boxes used in petroleum distillation. One solvents manufacturer has found that he could combine the simplicity of the bell-jar with the vapor-tight construction of the tail box by the use of the vapor-proof glass globes that have been developed by the lamp fixture manufacturers as a means of protecting electric light bulbs from the hazardous atmospheric conditions found in some plants.

These clear glass globes, which are about 5-in. in diameter and 10 to 12 in. in height, are threaded to fit a 4- or 5-in. socket. By means of a special gasket between the globe and hood, it is a simple matter to make a gas-tight joint. The chemical manufacturer found it desirable to use either a special pipe fitting or an iron or brass casting in the place of the socket or hood used in the lamp fixture. In this way the sight-box could be securely attached to the pipe carrying the condensate or other solution which it was necessary to observe or measure.

These heavy screw globes are not easily broken but in such an emergency they can be conveniently replaced. Since the globe is a standard product, widely used in other industries, it is much less expensive than are the glass bell-jars or similar accessories of more limited use.

Extraction Turbines Economical in Paper Mill

By using extraction type steam turbines for generating electrical power and bleeding steam for paper drying, the Kalamazoo Vegetable Parchment Co., Kalamazoo, Mich, saves a minimum of $12,804.48 per year and a maximum of $70,536.96 per year over other methods, according to a recent analysis made at that company. Three paper plants are operated, all the power for which is generated at two of the plants.

Steam is generated in Wickes vertical boilers and electricity is generated by 1250-kilowatt, General Electric turbine generators rated 480 volts, 3,600 r.p.m. For drying parchment 11,000 lb. of steam per hour at 5 lb. pressure is extracted from each turbine.

In the No. 1 mill variable speed engines are used to drive the paper machines, one rated 200 horsepower and the other, 300 horsepower. All the exhaust steam from the engines is used for drying. The electrical load of the mill is carried by a 1,250-kw. turbine generator, and 11,000 lb. of steam is extracted from the turbine for drying paper.

In the No. 2 mill, however, the paper machines are driven by General Electric sectional motor drive. The electrical load of the mill, including the paper machine motors, is carried by two 1,250-kw. turbine generators, and 22,000 lb. of process steam—sufficient to cover all the drying requirements of the mill—are extracted from the turbines.

By this method the turbines, in addition to driving their generators, are bled at the first stage of steam at a rate of 22,000 lb. per hour, thus obtaining as a by-product from the extracted drying steam and at practically no expense, approximately 1,630 kw. of electric power. If the paper machines in the No. 2 mill were driven by variable speed engines, as in the No. 1 mill, 500 horsepower would be required at not less than 35 lb. of steam per horsepower-hour. This would give, for drying purposes, but 17,500 lb. of steam per hour, whereas 22,000 lb. are required, costing $6.29 per hour. An additional 1,500 kw. of electrical power would be needed which, if furnished by a straight condensing turbine requiring 13.5 lb.

of steam per hour, would cost $5.79 per hour, making a total cost of $12.08 per hour. If the additional 1,500 kw. were purchased, they would cost the paper company $13.50 per hour, at a rate of $.009 per kilowatt-hour, making a total cost in that case of $19.79 per hour.

The present method, requiring 2,500 kw., costs $10.37 per hour. Thus there is effected a minimum saving of $1.71 per hour, or $12,804.48 per year, and a maximum saving of $9.42 per hour, or $70,536.96 per year. With the minimum saving, the paper company is paid a return of 45.8 per cent on its turbine and generator investment of $28,000.

Welded Pipe Joints Save Coil Costs

A certain company has found that in their Los Angeles plant, where condenser coils for ammonia are fabricated, much expense is saved by using welded joints instead of fitted joints. For instance, the average cost of building a joint, using special ammonia fittings, is $7.20 per joint—while the cost of the welded joint is about $1.50 complete. There are also other advantages obtained from the use of welding in this shop, in particular the elimination of gaskets which must be used with the fitted joints. Such gaskets are liable to deteriorate after some use and leaks result which cause losses of ammonia and annoyance to the operators and may even cause expensive shut-downs.

Economies in Filtering Caustic Solution

At the East St. Louis plant of the Monsanto Chemical Works the substitution of Monel metal cloth for steel cloth in filtering caustic solution has effected a reduction of 73 per cent in cost of the operation. The filtering tanks are 6 ft. in diameter and 2 ft. high with a false bottom on which the filter cloth is stretched, between two 12-mesh iron screens that serve to protect it.

The caustic solution, from which crystals of sodium sulphite and iron sludge are to be removed, has a temperature of 250 deg. F. and a specific gravity of 1.4. In an average run for one tank, 1,000 gal. of liquid is filtered in about 4 hours, a 24-in. vacuum beneath the cloth aiding gravity flow. The filter cloth is cleaned daily, being first scraped and then washed with a strong stream of water.

Under these conditions, operating 6 days per week, the average life of Monel metal filter cloth is about 6 months and some pieces have lasted as long as 8 months, while this company's experience with steel cloth has shown an average life of about one month in the same service. The annual cost of Monel metal cloth for 3 filters plus labor for installing is $558. The cost of steel cloth plus labor in installation would be $2,052 per year, showing a net saving in favor of Monel metal of $1,494 yearly.

One Way to Protect Parts Subjected to Wear

A recent issue of *Oxy-Acetylene Tips* tells of a novel method used by a large portland cement plant for protecting a part subjected to extraordinary wear. At this plant the shafts on a conveyor are protected by steel sleeves which under the severe operating conditions existing there formerly lasted but an average of six days. The cost of one of these sleeves was $9, and it usually required two men half a day to make one replacement of a full set. It is estimated that the production of cement at this plant is worth $250 per hour, so it would be readily seen that a half-day shut-down involved a loss far out of proportion to the value of the material that was being replaced.

This plant has now adopted the expediency of surfacing the sleeves with Stellite by means of an oxy-acetylene blow pipe. At the time the report was made the first set of sleeves so treated had been in service six weeks and as yet showed no sign of wear.

Some Experiences with Corrosion In Operating Work

Dr. Werner, superintendent of the material department of the Farbenfabriken vorm Baeyer at the last annual meeting of the German Anti-Corrosion Committee, gave some of his personal experiences with corrosion as met with in operating work. He found that temperature differences resulting from variations in heating loads led to corrosion. In some cases it is of assistance to insulate heating coils or to protect them by installing auxiliary electrodes according to the Cumberland method. It is a serious error to use high-grade and low-grade materials in the same piece of equipment. For instance, valves that failed because the stems consisted of some copper alloy while the body was of cast steel or ingot iron have been noted.

In attempting to obtain the proper material for caustic soda solution equipment, it was found that if coils and tubes consist of the same material both corrode, whereas if they consist of different material the tube remains uncorroded, while the coil is severely corroded. Impure iron, it is found, is always more strongly attacked by acids than pure iron.

Referring to the remarks of Palmaer, according to which iron that has not been drawn was less attacked than drawn material, Dr. Werner stated that investigations carried out at the Dahlem Material Testing Laboratory showed that the corroded regions coincided with the areas where the Frie lines appeared in the Frie etching method. Sulphuric acid storage tanks always showed corrosion effects at the points where the Frie lines appeared at the surface. In the case of mixed acids the results were worse. Further tests showed that hot-bent iron coils were not attacked as the corrability was diminished by the heat treatment. Thoroughly annealed sheet iron offers, therefore, better resistance than unannealed cold drawn sheets.

A case from plant practice showed that some steam distributors have given a service of 19 years for the inmost tube while the outer tubes broke down after only 3 years of service. The inner tube was of wrought iron and the outer tubes were of ingot iron. The outer tubes were cold drawn, but no cold deformation was present as the tubes were annealed after drawing. This shows that for certain conditions wrought iron gives better service than ingot iron. According to one works manager, wrought-iron tubes give better service than ingot iron in caustic soda equipment. It is not stated whether this difference was due entirely to the difference in composition or not.

Chromium Plated Electros Have Long Life

Many plants make use of electrotypes for printing labels, wrappers, and other items, particularly in connection with the production of drugs and fine chemicals which must be carefully labeled for safe handling. In this service ordinary electros produce about 200,000 impressions for each plate. Beyond that number of impressions fuzzy edges and shabby appearance of the printed matter is liable to result.

Certain plants have recently tried plating such electros with chromium and the results have been very successful. In one establishment this type of plate is used for printing wrappers, and it is reported that over 1,000,000 impressions have been obtained from each of several plates and that none of these plates as yet show the slightest sign of wear. It is evident that plants doing their own printing work can obtain a real advantage from the use of chromium plated electros.

Using Illuminating Gas For Metal Cutting

Illuminating gas to replace acetylene, hydrogen, or other gases in combination with oxygen for metal cutting has been successfully adapted by the Schenectady plant of the General Electric Co., following a comprehensive study of this class of work. A special torch has been developed for this purpose and is now being used for cutting risers in the steel foundry, the material varying in thickness from 1 to 20 inches.

According to the June issue of the *General Electric Review* this method is also used on machines in cutting intricate shapes for steel plates. Tests have shown that the use of illuminating gas is cheaper in machine cutting than either hydrogen or acetylene, while the speed of cutting after once starting is approximately equal for all gases. The advantages of the use of illuminating gas are found to be availability, elimination of delays and handling of tanks, low cost, safety, and chemical and physical properties permitting its use in a torch equipped with a super-heater, thus effecting large economies in the amount of oxygen required for the work.

Equipment News

From Maker and User

Weighing Truck

The National Scale Corporation, Chicopee Falls, Mass., are marketing an elevating hand truck which is equipped with a scale permitting of the accurate determination of the gross, net and tare weights of platform loads. This truck is said to save much time and labor by eliminating the use of separate scales and permitting the weighing of materials in transit. It is available in capacities of 2,000, 2,500 and 3,500 lb.

Heavy Duty Stacker

A heavy duty stacker with an enclosed worm drive is being marketed by Lewis-Shepard Co., Boston, Mass. This machine, called Type PB, operates with a 3 hp. motor, has a platform 30 x 36 inches and is made in capacities of 750, 1,000, 1,500 and 2,000 lb. with lifting speeds of 80, 60, 40 and 30 ft. per minute respectively. Lifting heights vary up to 12 ft. 4½ in., depending on the size. The frame is of structural steel, rivetted and welded. Roller bearings are used in the cable sheave and in the wheels. Lubrication is by the Alemite system.

Operation is by a hold-over, drum type reversing controller, with limit stops and self-adjusting, asbestos-lined brake band. The drive is by a steel worm, mounted on ball bearings, meshing with a bronze worm gear and operating in an oil bath.

Heating Element

A new process for insulating the element of an electrical heating device, particularly applicable to water heaters and hot plates, is being put out by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This process, which is known as the Backer process, has been in use in Europe for about two years. The right to its exclusive use in the United States has recently been purchased by the Westinghouse company.

The name of the element made by this heating system is "Pyrox," a name derived from pyrochroite, a white magnesium hydroxide crystallizing in the rhombohedral system. This material is obtained by the conversion of metallic magnesium into hydroxide by the application of steam at 300 lb. pressure. On the liberation of water by heating, the hydroxide is changed to an oxide.

In the manufacture of this element a ribbon of metallic magnesium is wound spirally around a nickel-chromium heating wire. For water heater elements this is inserted in a soft copper tube and steam at 300 lb. pressure is passed through it causing the chemical changes mentioned above. When this change is completed the copper tube is bent and tinned to prevent corrosion. Both ends of the tube are then soldered into the head of the heater in such a way that even if the head fills with water it is impossible for the water to run into the tube and short circuit the element. The process of manufacturing plates with this element is the same so far as the chemical action is concerned. The element is cemented into a groove in a cast iron plate and covered with layers of asbestos held in place by clamping plates.

The principal advantage claimed for these heaters is that they combine the quality of high electrical insulating value with that of good heat conductivity. It is further said that the insulating and conducting values are but slightly varied by increasing the flow of heat as long as this heat is not trapped in the element but is permitted to flow out freely. Tests are said to show a long life for the heater, the ability to withstand heavy overloads and the possibility of enclosing heating units with as great or greater heating efficiency as is obtained with the open unit.

Vibrating Screen

The Robins Conveying Belt Co., 15 Park Row, New York, N. Y., is introducing a new vibrating screen which is called the "Vibrex." This unit consists of three main parts: A vibrator driven by a belt from motor or countershaft, a live screen frame, and a stationary base frame so built that it may be readily attached to any type of supporting structure.

Four adjustable, unbalanced collars mounted on the vibrator drum give variable amplitude of vibration to meet different requirements. The drum is carried by means of Timken roller bearings on a transverse shaft rigidly connected to the live screen frame. This screen frame is connected to the base frame by coil springs, 10 in number, which serve the double purpose of absorbing the vibration of the screen and maintaining tension in the screen cloth. This cloth is fastened in place by removable grips or clamps.

Among the advantages claimed for this equipment is the fact that the entire screen frame is uniformly vibrated, thus eliminating dead and inactive areas of screen surface. Another claim is that of long life of screen cloth because there is no flexing of the individual wires that make up the cloth. The supporting springs minimize the escaping vibration and consequent power loss, thus enabling the unit to be operated with less than one horsepower.

Welding Torch

A small welding torch for work not requiring the usual standard torch has recently been put out by the Alexander Milburn Co., Baltimore, Md. This torch, which is called the type J-JR., is adapted to use gas supplied either from generators or from high-pressure tanks. It is made of bronze forgings and drawn stainless tubing. The angle of the head is 67½ deg., allowing a natural position of the hand when operating. It is 18 in. long, weighs 25 oz., and is furnished with 3 different tips making it adaptable to a wide range of service.

Vibratory Screen

The Pittsburgh Coal Washer Co., Pittsburgh, Pa., has developed a new vibrating screen in which vibration is imparted equally to all parts of the screen cloth area by means of an eccentric shaft rigidly connected to the supporting members of the screen frame, which is carried on spring suspension, and rotated by means of a belt and pulley. Self-aligning ball bearings are used on this eccentric shaft. All moving and wearing parts are above or outside of the path of the material screened. Lubrication is by high-pressure grease gun.

These screens are supplied in single deck or in multi-deck to effect a separation of several grades, or sizes. Sizes can be supplied to fill the capacity needs of various installations.

H-Ion Comparator

LaMotte Chemical Products Co., Baltimore, Md., has recently place on the market a new H-Ion Comparator called the Roulette. The set consists of a stationary base and metal band of circular design, and a wooden drum which revolves, inside the metal band, on ball bearings. An incandescent lamp is fixed in the middle of the base, provided with a cord and plug which may be attached to any lighting circuit. A block, which contains three slots and which is drilled to hold three graduated test tubes, is fastened to the front of the metal band. A piece of etched glass is placed in a holder between the lamp and the test tube block to give a uniformly diffused light. A piece of Daylite glass is also fixed in the test tube block so that the same standard daylight conditions are obtained at all times.

Any three sets of color standards, such as bromcresol purple, pH 5.2-6.8; bromthymol blue, pH 6.0-7.6; and phenol red, pH 6.8-8.4; and 27 ampoules of distilled water are supplied with the set. An extra case, containing three 50 ml. bottles of the corresponding in-

dicator solutions, three 0.5 ml. pipettes and 18 graduated test tubes, is part of the outfit.

The three sets of color standards are placed in the holes of the revolving drum, alternating with ampoules of distilled water. To make a determination, three test tubes are first filled to the 10 ml. mark with the solution to be tested. Then 0.5 ml. of the proper indicator solution is added to the middle tube which is shaken to insure thorough mixing. The test tubes are placed in the block and the drum revolved until the correct standards are behind the block and an exact match of the sample being tested with a standard is obtained, or until the color of the sample lies between the colors of the standards on either side of it. The pH value can then be read off directly from the label on the color standard.

Thickener

The United Filters Corporation, Hazleton, Pa., has recently brought out a new thickener called the "Sweetland" thickener.

This thickener employs a filter element as shown in Fig. 1, consisting of a corrugated redwood or cypress stick terminating in a casting at the top which serves as a drainage member. A hole is bored down the top of the stick for a few inches where it is met by radial holes drilled to conduct the filtrate from the outer corrugations into the inner longitudinal hole, whence the filtered solution passes out through the nipple.

Filter cloth is furnished stitched in tubular form open at both ends. After being slipped over the stock, as shown in Fig. 1, the ends are tied. The lug at the bottom is secured by a cross bar to hold the element in vertical position. Each element is 2¾ in. in dia., and 48½ in. in length. The net filter area of each element is 2.6 sq. ft. The element when dry weighs 6½ lb. These elements are assembled on headers of steel pipe into which nipples have been welded. One end of the header is closed and the other is provided with a coupling to unite it to the outlet fitting which passes through the side of the tank.

As can be seen in Fig. 2 the headers are assembled in parallel rows in a steel tank with coupling-ends alternated, so that every other one connects with the manifold on one side of the tank, and the alternate one connects with the manifold on the other side. The headers and filter elements are all interchangeable and the arrangement is such that the elements are compactly placed in staggered rows throughout the tank. Each header communicates with its manifold through a gage glass and shut-off valve as shown in Fig. 2, so that the outflowing filtrate from each header is visible. Thus in case of a leak this header may be shut off. Special heat resisting glass is used in these fittings.

The tank is of steel plate, riveted at the main seams and reinforced against bulging by ribbing of structural steel. The thickness of this tank varies according to the size. The upper portion is in the form of a rectangular box,

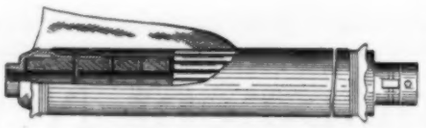


Fig. 1—Elevation and Partial Section of Thickener Element

while the lower portion is sloped as shown in the figure terminating in a rounded bottom which accomodates a right and left hand scroll conveyor which is used for propelling the sludge towards the outlet at the center. The feed may be located in various places but is generally placed as shown in Fig. 2 at the end adjacent to the point where the two manifolds converge to unite with the pump connection. On one end of the tank extending over its full width is an overflow lip to carry off the surplus feed. This empties into a hopper built integral with the tank and terminates in a pipe flange at its lowermost point. The overflow lip is 17 in. above the top of the header giving a static head which based upon cold water is equivalent to 1.2 in. of vacuum. It will be noted that by this design the static head assists the vacuum of the pump and the filtrate is given a constant downward flow through the force of gravity. The manifolds on either side of the tank are connected into the section of an automatically reversing wet vacuum pump. This pump is capable of producing a partial vacuum on one side and discharging against a head on the other side depending upon the direction of rotation. It is driven by a reversing electric motor. In operation this motor is reversed at proper intervals to produce the correct cycle of operation by means of a rotary switch mechanism actuated by a ¼ hp. motor. The rotating elements of this mechanism are back-geared to make one revolution for each cycle of operation. This mechanism allows a light current to pass through the solenoids of a suitably designed switchboard, where the heavier current required to operate the pump motor is alternately thrown into the two sets of wires which lead to the pump motor connection. The timing apparatus is so built that it can be set by a simple changing of gears and switch segments set for any desired cycle of operation; that is, the time for withdrawing filtrates and for reversing may be adjusted to give the best operating conditions for a particular material, after which it can be left permanently at that setting.

The removal of thickened material or sludge is effected by connecting a diaphragm pump to the flange at the center of the bottom of the tank. Such a pump is usually located at a level adjacent to the level of the liquid in the tank and its capacity is made adjustable by varying the speed or stroke. The density of the thickened material is varied to conform to requirements by varying the rate at which it is withdrawn.

An alternative method of discharging the sludge is to connect a pipe with the bottom flange which terminates in a valve located alongside the tank about midway between the liquor level and the tank bottom. In this case the density and rate of discharge are regulated by the valve.

The cycle of operation when operating on beet sugar juice, which is one of the prominent applications of the thickener, is as follows: The main feed valve is open and the tank filled to overflowing with juice. A line switch to conduct current to the electrical apparatus is closed and the rotary switch puts the pump in motion in forward direction. A large volume of clear juice is drawn through the filter elements by the suction of the pump. This is discharged wherever desired to suit plant conditions. At the end of three minutes, a layer of carbonate of lime, probably ⅛ of an inch in thickness, has formed on the several hundred square feet of filter surface. The resistance of this lime cake naturally impedes filtration to a certain extent. At this time the rotary switch has reached the

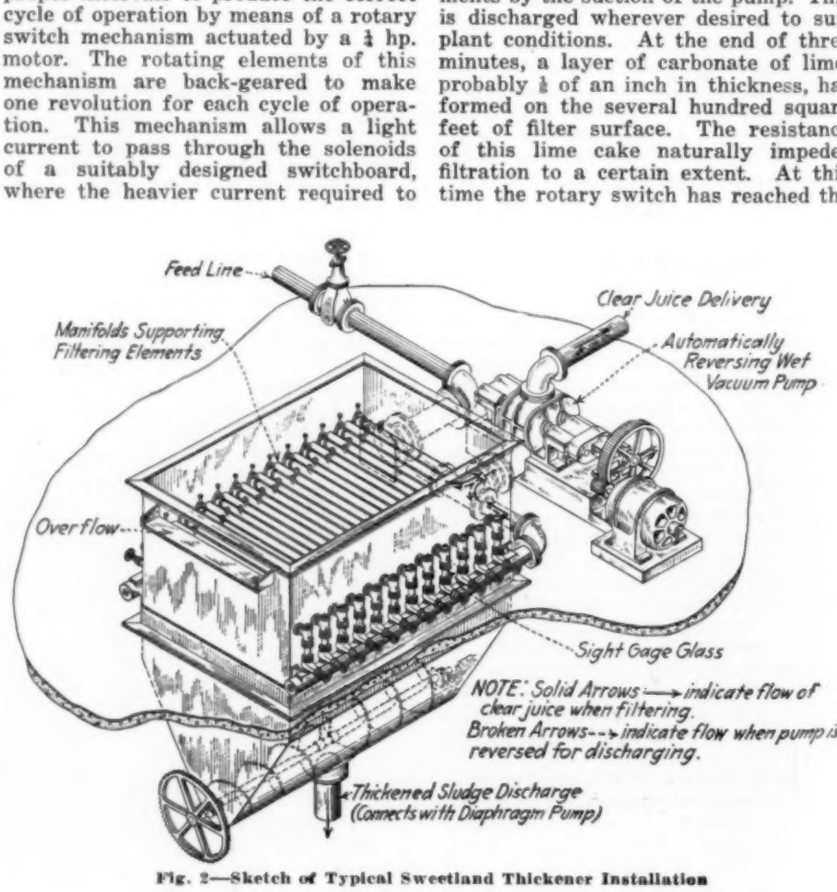

Feed Line
Clear Juice Delivery
Manifolds Supporting Filtering Elements
Automatically Reversing Wet Vacuum Pump
Over flow
Sight Gage Glass
NOTE: Solid Arrows ——→ indicate flow of clear juice when filtering.
Broken Arrows - - → indicate flow when pump is reversed for discharging.
Thickened Sludge Discharge (Connects with Diaphragm Pump)

Fig. 2—Sketch of Typical Sweetland Thickener Installation

contact which causes the pump to reverse and the flow of filtrate immediately stops. The pump now running in the reverse direction inflates the filter bags for a few seconds causing the cake to be dislodged and fall to the bottom of the tank. The pump now reverses again and runs forward pumping filtrates for another three minutes. These reverses continue automatically for an indefinite period without any need for attention on the part of the operator.

Car Spotter

A new type of electric motor driven car spotter was recently placed on the market by H. W. Caldwell & Son Co. of Chicago, Ill. This spotter is of the vertical capstan type. The machine is recommended for other uses besides moving cars, including such operations as the movement of materials in factory yards. It is available in two sizes, one with a speed of 40 to 60 ft. per min., while moving one, two or three cars, and the other a speed of 26 to 42 ft. per min. while moving from three to six cars. This device is claimed by the makers to be of simple and reliable construction and is said to be available at a low price.

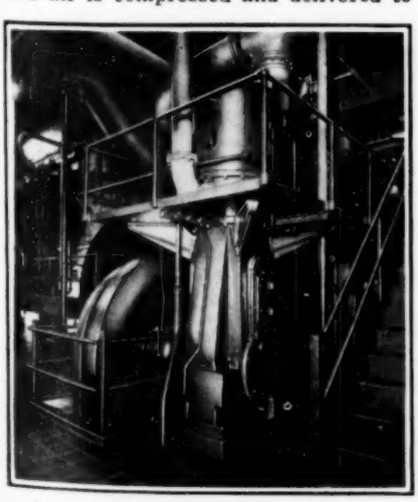
Vacuum Pump

In the design of the famous high pressure Edgar (Weymouth) Station of the Edison Electric Illuminating Co. of Boston, motor-driven, rotative dry vacuum pumps of a new type were developed by the Worthington Pump & Machinery Corporation, 115 Broadway, New York, N. Y.

The air end of these pumps is similar to the Worthington 2-stage, single cylinder, horizontal, feather valve dry vacuum pump, except that the cylinder is vertical and additional valves are located in the piston itself. The air suction pipe from the condenser enters the upper portion of the pump cylinder, the air being drawn in on the down stroke of the pump. On the up stroke, the air flows from the upper side of the piston to the lower through the valves in the piston. On the next down stroke, this air is compressed and delivered to atmosphere, thus giving a 2-stage effect in one cylinder.

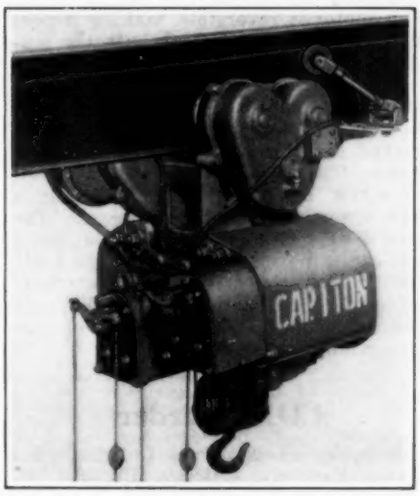
There is practically no compression in the first stage, thus avoiding the loss in volumetric efficiency that occurs in pumps of the single stage type when the air re-expands in the clearance space. The cylinder and heads are water-jacketed which results in condensing much of the vapor in the first stage of the cylinder. This condensate flows through the valves in the piston to the lower half of the cylinder from whence it is discharged. This also avoids any water pockets and the possibility of flashing into vapor with drop in pressure on the suction stroke. The frame is thoroughly enclosed and all bearings are lubricated by a forced-feed pump driven from the main shaft.

Direct connected motor drive from a motor running at 120 r.p.m. is used. On closed suction the pump is capable of maintaining an absolute pressure of 0.1 in. of mercury.



Vertical Rotative Dry Vacuum Pump

This view shows a machine of this type installed in the Edgar Station of the Edison Electric Illuminating Co., Boston, Mass.



Motor Trolley for Small "Lo-Hed" Hoists

As the whole unit requires but 22 in. headroom, it can be used in many places where larger units cannot be accommodated

Motor Trolley for Hoists

A new motor-driven trolley has been developed by the Amercian Engineering Co., Philadelphia, Pa., for use with its ½- and 1-ton, Class A, "Lo-Hed" electric hoists, which have been built, heretofore, in bolt-suspension and plain trolley types only.

The trolley can be supplied with travel speed of 80 or 120 ft. a minute, so that the trolley and hoist provide an inexpensive overhead system for handling loads of one ton or less at high speed, both in lifting and moving. It can be arranged for remote control, if desired. Any Class A, "Lo-Hed" hoist now in service can be easily converted into a motor trolley hoist by adding the new trolley.

Only 22-in. headroom is required for hoist and trolley, which is very small for a motor trolley hoist. The trolley is ruggedly built and maximum traction is obtained by driving all four wheels. The three main castings, from which the hoist and load are suspended, are of cast steel. The spur gear drive is totally enclosed and runs in an oil bath. Hyatt roller bearings are used on all shafts. The motor also is totally enclosed and has high grade ball bearings. All parts are completely accessible and the motor can be removed readily when necessary. The motor can be furnished for D.C. or A.C., either 2- or 3-phase.

Motor Starters

Two new types of across-the-line starters, the reversing and the non-reversing type, have recently been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. These starters have been designed for easy accessibility in installing and wiring. Two slotted hexagonal screws hold the starter unit in place in a sheet steel cabinet. The starter may be taken out as a unit by merely removing the screws, thus leaving all the room inside the cabinet for attaching conduit bushings and drawing in the leads.

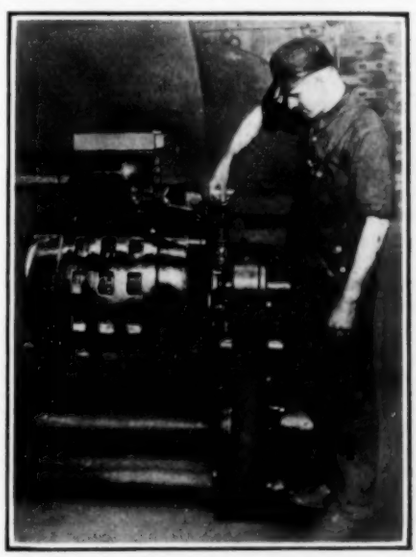
The starter, consisting of a three pole contactor with electrical interlock, is completely enclosed and is operated entirely from a push button station placed at any convenient location. In this way it provides safe control and eliminates damage caused by tampering or unskilled handling. A floating armature type of three pole contactor is used and is said to provide smooth and positive contact. It is designed for quiet operation and the contactor tips are kept clean by the rolling and wiping action in closing, thus preventing any tendency to heat or weld under load.

Where operating conditions necessitate the protection of the starter from foreign matter, a door interlock is supplied which makes it impossible to start the motor unless the door is fully closed.

Method of Lubricating

In providing a lubricating system for its ball bearing type of electric motors, Fairbanks-Morse & Co., Chicago, Ill., have developed the system shown by the accompanying photograph.

The grease for lubrication is furnished in collapsible tubes, each one containing enough grease for one year's lubrication of the motor. After flushing out the old grease with kerosene as



New System for Lubricating Bearings

The collapsible tube here shown contains sufficient grease to lubricate the bearing for one year. Its application is simple and cleanly.

directed in the instructions supplied with the tube, grease is squeezed from the tube directly into the bearing. Directions with the tube show just how much should be put into each bearing for the best results. Four sizes of tubes are available for four corresponding sizes of bearings.

The opening of the tubes is designed to fit the opening in the lubricating plug of the bearing so that the grease is placed directly where wanted with no waste.

Screen Hopper

A new hopper for use with vibratory screens has been placed on the market by Link-Belt Co., Chicago, Ill. In addition to its service in acting as a receiving hopper for feeding material to screens, this device is said to be an excellent means of distributing the material across the full width of the screen cloth thus obtaining a maximum efficiency of screening.

The device combines an automatic feeder for the screen with a hopper. It vibrates with the screen and enables the material to be spread across the full width of the screen throughout its full length. By its use the feed is automatically regulated through a swinging feed plate with counterweight arrangement. This plate also serves to distribute a non-uniform load uniformly across the width of the feeder. It is claimed by the makers of this device that when used in conjunction with their vibrating screens, a high degree of screening efficiency is obtained.

Oil Pump

The Worthington Pump & Machinery Corporation, 111 Broadway, New York, N. Y., has developed a forged-cylinder pump for feed and auxiliary oil pipe lines. This pump is said to be a self-contained, substantial and rigid unit of compact design.

Capacities are available up to 40,000 bbl. per 24-hr. day. Pumps are designed for working pressures close to 1,000 lb. per sq.in. Cylinders and passages are tooled out of solid machine steel forgings. The throats are bronze lined with deep stuffing boxes. Flow is straight and all clearances are close. The plungers are machined and ground from high-grade steel. The valve chambers are tooled out of the cylinder forging. Steel ball valves of the encaged type operating on hard gear-bronze renewable seats are used. Each of these valves is separately accessible from above through individual valve chamber covers. The crankshaft and connecting rods are steel forgings.

Portable Pipe Machine

The Oster Mfg. Co., Cleveland, Ohio, has recently introduced a light weight model of their power drive for pipe tools. The body of this machine is made almost entirely of an aluminum alloy said to be stronger and more durable as well as lighter than cast iron. The weight of the machine is 150 lb. Power is from a ½ hp. universal motor which automatically speeds up on the smaller sizes of pipe and holds the necessary speed on the larger sizes. This motor is reversible, making it possible to use any die stock with the machine.

This machine will drive die stocks and pipe cutters up to 2 inches and, with an auxiliary drive shaft, will drive geared die stocks and cutters up to 6 inches. The machine can also be used to screw up fittings by fastening a pipe wrench in its driving arms. The pipe is held stationary in a three-jawed self-centering chuck and the pipe tools are turned by driving arms. Self-centering universal guides in the rear of the machine assist the chuck in centering long lengths of pipe.

CO_2 Recorder

Republic Flow Meters Co., 2240 Diversey Parkway, Chicago, Ill., has developed a motor-driven CO_2 recorder that is claimed to have many improved features. All working parts are immersed in oil. The case is dirt and dust proof, the only opening being at the top, where the cover is constructed for tight closing. A fractional horsepower motor is used.

In operation, the gases are drawn from the furnace into the instrument through a brass tube immersed in oil. The gases pass through the pump and then through a brass tube to a measuring chamber. During this passage, the gases assume the temperature of the surrounding oil. They then pass into a measuring chamber, also immersed in the oil and are measured at a definite temperature. Next they pass through the potash chamber and then to a final chamber, also immersed in the oil, for a second measuring. The difference in these two measurements indicates the CO_2 content.

Manufacturers' Latest Publications

De La Vergne Machine Co., 949 E. 138th Street, New York City—A folder describing vertical Diesel oil engines.

Morehouse Machine Co., York Pa.—A bulletin describing a Proving Ring for calibrating Brinell hardness testing machines.

Alexander Milburn Co., Baltimore, Md.—Catalog No. 172-C—A new catalog illustrating the complete line of welding and cutting equipment made by this company.

Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill.—Catalog No. 200—New general catalog of the gears, speed reducers and special machinery made by this company with an added engineering section of over 200 pages of valuable tabular data, and formulas useful in the solving of transmission problems.

Roller-Smith Co., 233 Broadway, New York City.—Supplement to Bulletin No. 530—A folder describing direct acting time limit attachments for standard type circuit breakers.

The Toledo Metal Furniture Co., Toledo, Ohio—A bulletin describing the Uhl steel "PosturChair" specially designed seat for industrial purposes.

Reiter Co., Elgin, Ill.—Catalog No. E-40—A description of the Elgin system of internal softening and purifying of water for steam boilers.

Sullivan Machinery Co., 122 S. Michigan Ave., Chicago, Ill.—Bulletins No. 76-G and 83-B (second edition)—The first of these bulletins describes a portable electric hoist of single and double drum type, and the second of these bulletins describes belt-driven air compressors of single and 2-stage type.

W. D. Mount, Lynchburg, Va.—Bulletin No. 6—A bulletin describing the use of a rotary vacuum filter for washing pulp.

Lewis-Shepard Co., Watertown Station, Boston, Mass.—General catalog of factory lift trucks, skid platforms and tiering machines.

Kinney Manufacturing Co., Boston, Mass.—Catalog of the new "Heliquad" pumps for all types of pumping service.

Mantle Engineering Co., Oliver Building, Pittsburgh, Pa.—A bulletin describing the Mantle unit recuperator or air preheater.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. — Leaflet No. 20286—A description of static condensers for power factor correction on motor circuits of 220, 440 and 550 volts.

Combustion Engineering Corporation, 43 Broad Street, New York, N. Y.—Catalog GFD-1—A catalog describing Green forced draft stokers.

DuPont Cellophane Co., 40 West 40th St., New York, N. Y.—A new booklet entitled "Your Product in a Show-case of its Own," describing the use of Cellophane for packaging various products.

International Nickel Co., 67 Wall St., New York, N. Y.—Bulletins No. 4, 5, 201, and 202—New bulletins on applications of nickel describing respectively the use of nickel for making steel castings stronger, the mill inspection of steel, the properties and applications of nickel and nickel-chromium cast iron, and the improvement of gray cast iron with nickel.

Wellman-Seaver-Morgan Co., Cleveland, O.—Bulletin No. 85—A bulletin describing type L mechanical gas producers and their operation.

Leeds & Northrup Co., Philadelphia, Pa.—Catalog No. 87 and Bulletin No. 985—The first of these bulletins describes the construction and use of potentiometer pyrometers and the second discusses frequency measurements and control.

Worthington Pump & Machinery Corporation, 115 Broadway, New York, N. Y.—Bulletin No. BK-1607-D—A catalog describing locomotive feedwater heaters and boiler feed pumps.

American Blower Co., Detroit, Mich.—Two folders describing man-cooling fans and a bulletin on electric ventilation, giving descriptions of various types of ventilating installations.

Republic Flow Meters Co., 2240 Diversey Parkway, Chicago, Ill.—A folder describing a new motor driven CO_2 recorder, an article by G. F. Gebhardt on boiler evaporation tests, an article by C. W. Parmelee on water in the manufacture of heavy clay products, and an article by H. M. Boylston on the composition and structure of iron and steel.

Ingersoll-Rand Co., 11 Broadway, New York, N. Y.—Form No. 1414—A catalog describing surface condensers made by this company, the accessories used with them, their operation and containing an appendix giving engineering information on condensers.

De La Vergne Machine Co., 966 East 138th Street, New York, N. Y.—A bulletin containing a reprint of an article by C. E. Beck, describing "A Model Oil Engined Power Station."

The Duriron Co., Inc., Dayton, Ohio.—Bulletin No. 144—A bulletin describing valves, cocks and ejectors of acid proof material.

Patterson Foundry & Machine Co., East Liverpool, Ohio—Two new leaflets, one on grinding-room service for the enameler and the other describing the Patterson design of disintegrator.

General Electric Co., Schenectady, N. Y.—New bulletins as follows: GEA-388, a bulletin describing the type MT control equipment for direct current series wound crane bridge and trolley motors; GEA-380, a bulletin describing the helicoil sheath wire heating element; GEA-423, a booklet describing the use of arc welding in the General Electric factories.

Nashville Industrial Corporation, Old Hickory, Tenn.—Catalog No. 24—A general catalog of used equipment of all types available from the Old Hickory Powder Plant and other industrial companies.

U. S. Electrical Manufacturing Co., Los Angeles, California—Folder describing the use of automatic starting ball bearing motors.

Holly Pneumatic Systems, Inc., 100 East 45th St., New York, N. Y.—A folder describing the Holly system of pneumatic conveying.

Drying Systems, Inc., 1800 Foster Ave., Chicago, Ill. — A folder describing the Phoenix automatic constant-effect air filter.

American Pulverizer Co., St. Louis, Mo.—A leaflet describing the No. 13 ring pulverizer.

Steere Engineering Co., Detroit, Mich.—New bulletins as follows: No. 294-295 describing stack valves and steel stacks; Pamphlet No. 302, describing a charging machine for water gas generators; Pamphlet No. 304, describing a 72-in. special welded steel Tee.

U. T. Hungerford Brass & Copper Co., Lafayette & White Sts., New York, N. Y.—A new general catalog of various metal products stocked by this company.

Patents Issued June 1 to 29, 1926

Paper, Pulp and Sugar

Chemical Pulp-Cooking Process. George Sivola, Dexter, N. Y.—1,590,987.

Process for the Production of Wood Pulp. Henry Francis Joseph Puttaert, San Francisco, Calif.—1,587,799.

Machine for Treating Paper Stock. William J. Herrbold, Tonawanda, N. Y. — 1,586,951.

Process of Making Pulp from Hulls. Jean Francois Puttaert and Henry Francis Joseph Puttaert, San Francisco, Calif. — 1,588,335.

Method and Machine for Manufacturing Paper. Ezekiel J. Wilson, East Greenbush, and Edwin A. Rees, Albany, N. Y., assignors to F. C. Huyck & Sons, Rensselaer, N. Y.—1,589,450.

Paper-Making Machine. Alonzo Aldrich, Beloit, Wis.—1,589,921.

Paper-Making Machinery. Ernst Mahler, Neenah, Wis., assignor to Paper Patents Company, Neenah, Wis.—1,587,784.

Waterproofing Compound and Paper Waterproofed Thereby. Herbert Buffington, Seattle, Wash., assignor, by mesne assignments, to Buffington Waterproof Paper Corporation, Seattle, Wash.—1,589,103.

Rubber and Synthetic Plastics

Method of Making Molded Rubber Product. Chauncey C. Loomis, Yonkers, N. Y., assignor to Loomis, Stump & Banks. — 1,587,537.

Rubber-Coated Metal and Method of Production. Edward S. Avery, East Hampton, N. Y.—1,587,742.

Process for Removing Sulphur from Vulcanized Rubber. Leland L. Odom, Memphis, Tenn., assignor of one-third to E. M. Ellis, Memphis, Tenn., and one-thrid to J. D. Reynolds, Camden, Ark.—1,587,408.

Process for the Manufacture of Artificial Resins. Rudolf Singer, Brno, Czechoslovakia, assignor to Kunstharzfabrik Regal & Co., Brno, Czechoslovakia.—1,590,961.

Process of Treating Resins and the Product Thereof. Cyrus Field Willard, San Diego, Calif.—1,587,622.

Method of Molding Phenolic Condensation Products. Franklin S. Smith, Philadelphia, Pa., assignor to The Products Protection Corporation, New York, N. Y.—1,586,850.

Sulphur Phenol Resins and Process of Making Same. Alexander Blumfeldt, Basel, Switzerland, assignor to Society of Chemical Industry in Basle, Basel, Switzerland. — 1,588,439.

Aqueous Emulsion of Unvulcanized Rubber and Sulphur. Samuel E. Sheppard and Leon W. Eberlin, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y.—1,589,331.

Manufacture of Colored Cellulose Plastics and Solutions Thereof. Carl Immerheiser, Ludwigshafen-on-the-Rhine, Carl Neubauer, Mannheim, and Erwin Scharf, Ludwigshafen-on-the-Rhine, Germany, assignors to Badische Anilin- & Soda-Fabrik, Ludwigshafen-on-the-Rhine, Germany.—1,589,700.

Process of Reducing the Viscosity Characteristics of Nitrocellulose. Leonard E. Branchen, Rochester, N. Y., assignor to Eastman Kodak Company, Rochester, N. Y. —1,588,089.

Petroleum Refining

Art of Treating Hydrocarbons and Oils. Louis Bond Cherry, Kansas City, Mo., assignor, by mesne assignments, to C. and C. Developing Company, Kansas City, Mo. — 1,588,308.

Treating Mineral Oils. George L. Fogler, Tulsa, Okla.—1,587,111.

Oil-Treating Apparatus. Edward A. Dieterle, Glen Ellyn, Ill.—1,589,631.

Apparatus for Refining Hydrocarbon Materials. Frank M. Floyd, Dallas, Tex. — 1,587,370.

Process of Treating Hydrocarbons. Roy Cross, Kansas City, Mo.—1,587,491.

Process of Preparing a Lubricating Oil. Wirt D. Rial, Wilmington, Calif.—1,587,859.

Art of Distillation. Joseph Schneible, Chicago, Ill.; Beatrice Schneible-Ingram, administratrix of said Joseph Schneible, deceased, assignor to Claude D. Schneible, K. F. Schrerer, and Benamin B. Schneider, as trustees under the name of The Schneible Trust.—1,587,188.

Process for Treating Petroleum Emulsions. Melvin De Groote, St. Louis, Mo., assignor to Wm. S. Barnickel & Company, Webster Groves, Mo.—1,590,617.

Process of Manufacturing Oil of a Low Boiling Point from Mineral Heavy Oils. Tsuguyoshi Mii, Yamaguchi-Ken, Japan, assignor to Kotaro Isomura, Yamaguchi-Ken, Japan.—1,590,640.

Art of Converting Hydrocarbon Oils into Lower Boiling Products. Frank A. Howard, Elizabeth, N. J., assignor to Standard Development Company.—1,586,994.

Conversion of High-Boiling Hydrocarbon Oils into Lower-Boiling Oils. Perry J. Sweeny, Whiting, Ind., assignor to Standard Oil Company, Whiting, Ind., and Chicago, Ill.—1,589,908.

Process of Refining Oils and Fats. Frank Curtis Gephart, New York, N. Y., assignor to Cocoa Products Company of America, Incorporated, Long Island City, N. Y.— 1,588,405.

Process for Cracking Coal and Oil. Walter Edwin Trent, Washington, D. C. — 1,589,023.

Method of and Apparatus for Continuously Separating Petroleum Sludge. Ingenuin Hechenbleikner and Thomas C. Oliver, Charlotte, N. C.—1,586,801.

Purification of Hydrocarbons. Charles R. Downs, Cliffside, N. J., assignor to The Barrett Company.—1,590,965.

Desulphurizing Oils. Ernst M. Johansen, Fall River, Mass., assignor to The Atlantic Refining Company, Philadelphia, Pa. — 1,587,649.

Motor Fuel. Robert A. Carroll, West Finley, and Henry L. Elliott, Washington, Pa., assignors of one-third to James V. Elliott, Buffalo Township, Pa.—1,587,899.

Organic Processes

Trisazo Dyestuffs and Process of Making Same. August Leopold Laska and Fritz Weber, Offenbach-on-the-Main, Germany, assignors to Corporation of Chemische Fabrik Griesheim-Elektron, Frankfort-on-the-Main, Germany.—1,590,042.

Manufacture of Yellow Azo Dyestuffs. August Dorber, Ludwigshafen-on-the-Rhine, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,590,728.

Azo Dyestuffs and Process of Making Same. August Leopold Laska and Arthur Zitscher, Offenbach-on-the-Main, Germany, assignors to Corporation of Chemische Fabrik Griesheim-Elektron, Frankfort-on-the-Main, Germany.—1,587,004.

Yellow Monoazo Dyestuffs and Process of Making Same. August Leopold Laska and Fritz Weber, Offenbach-on-the-Main, Germany, assignors to Corporation of Chemische Fabrik Griesheim - Elektron, Frankfort - on - the - Main, Germany. — 1,587,005.

Blue Monoazo Dyestuffs for Wool or Silk. Adolphe H. Ney, New York, N. Y., assignor to Theodore Haebler, New York, N. Y. — 1,586,693.

Azodyestuffs and Process of Making Same. Arthur Zitscher, Offenbach-on-the-Main, Germany, assignor to The Corporation of Chemische Fabrik Griesheim-Elektron, Frankfort-on-the-Main, Germany. — 1,587,060.

Azodyestuffs Containing Chromium and Process of Making Same. Max Isler and Lucas von Mechel, Basel, Switzerland, assignors to Society of Chemical Industry in Basle, Basel, Switzerland.—1,588,458.

Process for the Reduction of Azo Compounds to Hydrazo Compounds. Oliver W. Brown, Bloomington, Ind., and Clyde O. Henke, South Milwaukee, Wis., assignors to The Newport Company, Carrollville, Wis.— 1,589,936.

Vat Dyestuff and Process of Making Same. Wilhelm Eckert and Heinrich Greune, Hochst-on-the-Main, Germany. — 1,588,451.

Vat Coloring Matter. Heinrich Neresheimer, Ludwigshafen-on-the-Rhine, Germany, assignor to Badische Anilin- & Soda-Fabrik, Ludwigshafen-on-the-Rhine, Germany.—1,589,303.

Vat Sulphide Dyes. Fritz Ballauf Friedrich Muth and Albert Schmelzer, Elberfeld, Germany, assignors to Grasselli Dyestuff Corporation, New York, N. Y.—1,590,718.

Quinone Vat Dyestuff, Dyeing Particularly Animal Fibers in the Vat Fast Shades, and Process of Making Same. Richard Herz, Frankfort-on-the-Main, Germany, assignor to Grasselli Dyestuff Corporation, New York, N. Y.—1,588,384.

Violet Vat Dyestuffs of the 2-Thionaphthene-2-Indolindigo Series. Richard Herz and Walter Brunner, Frankfort-on-the-Main, Germany, assignors to Grasselli Dyestuffs Corporation, New York, N. Y. — 1,590,685.

Process for Manufacturing Vat Dyes. Alois Zinke and Franz Hanselmayer, Graz, Austria, assignor, by mesne assignments, to Felice Bensa, Genova, Italy.—1,586,730.

Indigo Dyestuff. Sailendra N. Gupta, San Francisco, Calif.—1,588,960.

Dye Composition. Joseph Merritt Matthews, New York, N. Y., assignor to Glorient, Inc., New York, N. Y.—1,588,482.

Basic Dyestuffs of the Malachite-Green Series. Rudolf Reyher, Offenbach-on-the-Main, Germany, assignor to Chemische Fabrik Griesheim-Elektron, Frankfort-on-the-Main, Germany.—1,588,052.

Dyestuffs Containing Metals and Process of Making Same. Fritz Straub, Basel, and Herman Schneider, Riehen, near Basel, Switzerland, assignors to Society of Chemical Industry in Basle, Basel, Switzerland.— 1,590,482.

Production of Benzanthrone Derivatives. Georg Kalischer, Mainkur, near Frankfort-on-the-Main, and Rudolf Müller and Fritz Frister, Fechenheim, near Frankfort-on-the-Main, Germany.—1,588,376.

Process for the Manufacture of 2:3-Diamino-Anthraquinone. Wilhelm Moser, Basel, Switzerland, assignor to Society of Chemical Industry in Basle, Basel, Switzerland.—1,586,911.

Preparation of Solutions of Derivatives of Dioxydiaminoarsenobenzene. Stuart R. MacEwen, Toronto, Ontario, Canada. — 1,588,252.

Process for Manufacturing Perylene Compounds of Quinone Character. Alois Zinke, Gratz, Austria, assignor to Felice Bensa, Genova, Italy.—1,590,661.

Process of Dyeing Cellulose Esters and Cellulose Ethers. Walter Duisberg and Winfried Hentrich, Leverkusen, Claus Weinand, Cologne-on-the-Mulheim, and Ludwig Zeh, Leverkusen, Germany, assignors to Grasselli Dyestuff Corporation, New York, N. Y.—1,587,708.

Process of Dyeing Cellulose Esters and Ethers. Carl Erich Müller, Hochst-on-the-Main, Germany, assignor, by mesne assignments, to Grasselli Dyestuff Corporation, New York, N. Y.—1,587,669.

Hydroxy Benzoylamino - Benzenearsonic Acids and Process for Making the Same. Ludwig Benda, Mainkur, near Frankfort-on-the-Main, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,588,381.

Process for Manufacturing Amino Perylene Quinones. Alois Zinke, Graz, Austria, assignor, by mesne assignments, to Felice Bensa, Genova, Italy.—1,586,729.

Process of Making Crotonaldehyde. Fred W. Lommen, Pittsburgh, Pa., assignor to Carbide & Carbon Chemicals Corporation.— 1,587,661.

Monoiodo-Oxindol and Process of Making Same. Walter Schoeller, Berlin-Westend, and Kurt Schmidt, Berlin-Friedenau, Germany, assignors to Chemische Fabrik auf Actien (vorm. E. Schering), Berlin, Germany.—1,587,866.

N-Acyl Derivatives of 5-Amino-3-Chloro-4-Hydroxybenzene-1-Arsonic Acid. Ludwig Benda, Mainkur, near Frankfort-on-the-Main, and Werner Schmidt, Fechenheim, near Frankfort-on-the-Main, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft.—1,588,382.

Benzoyl-Ecgonine Ester and Process of Producing the Same. Edvard Poulsson, Oslo, Norway.—1,588,466.

Sulphonated Thianthrenes Useful as Pharmaceutical Compounds. Heinrich Herminghaus, Elberfeld, Germany, assignor, by mesne assignments, to Winthrop Chemical Company, Inc., New York, N. Y. — 1,589,390.

Process for the Manufacture of Ethyl Sulphuric Acid. Augustin Amédée Louis Joseph Damiens, Arcueil-Cachan, and Marie Charles Joseph Elisée de Loisy, Paris, France, and Olivier Joseph Gislain Piette, Brussels, Belgium.—1,589,372.

Process for Manufacturing Acetic Anhydrids. Ludwig Hörmann, Tschechnitz, near Breslau, and Felix Kaukler, Munich, Germany, assignors to the Firm: Dr. Alexander Wacker-Gesellschaft für Elektrochemische Industrie G. m. b. H., Munich, Bavaria, Germany.—1,590,097.

Process of Polymerizing Vinyl Esters. Willy O. Herrmann and Erich Baum, Munich, Germany, assignors to Consortium für Elektrochemische Industrie, Munich, Germany.—1,586,803.

Process of Making Propylene Oxides. John N. Burdick, Buffalo, N. Y., assignor to Carbide and Carbon Chemicals Corporation. —1,589,359.

Basic Phenolalkylethers. Hans Hahl, Elberfeld, Germany, assignor, by mesne assignments, to Winthrop Chemical Company, Inc., New York, N. Y.—1,587,073.

Process of Making Olefine Oxides. John N. Burdick, Buffalo, N. Y., assignor to Carbide and Carbon Chemicals Corporation. —1,589,358.

Process of Producing Nitrogen Compounds and Apparatus Therefor. Edwin S. Matthews, New York, N. Y.—1,586,823.

Process for the Catalytic Oxidation of Organic Compounds. Charles Raymond Downs, New Haven, Conn.—1,589,632.

Process for Producing Organic Chlorides. Richard Thurm, Saginaw, Mich.—1,590,265.

Method of Preparing Cyanogen Chloride. Ralph V. Heuser, Elizabeth, N. J., assignor to American Cyanamid Company, New York, N. Y.—1,588,731.

Process of Obtaining Absolute Alcohol. John A. Steffens, Baltimore, Md., assignor to U. S. Industrial Alcohol Co.—1,586,717.

Apparatus for Obtaining Absolute Alcohol. John A. Steffens, Baltimore, Md., assignor to U. S. Industrial Alcohol Co. — 1,586,718.

Absolute-Alcohol Process. Elwood I. Clapp, Baltimore, Md., assignor to U. S. Industrial Alcohol Co.—1,586,732.

Process for Reclaiming Tar and Light Oil. William F. Dietzsch, Chicago, Ill. — 1,589,374.

Distillation of Solid Material. Oskar Lasche, deceased, late of Berlin-Charlottenburg, Germany, by Fritz Lasche, executor, Berlin-Charlottenburg, and Carl Geissen, Berlin-Schoneberg, Germany, assignors to Kohlenveredlung G. m. b. H., Berlin, Germany.—1,590,895.

Process for the Destructive Distillation of Wood. John Stanley Morgan, London, England, assignor to Thermal Industrial and Chemical (T. I. C.) Research Company, Limited, London, England.—1,590,901.

Method for the Production of Highly-Active Charcoal from Wood. Paul Wöhler, Mannheim-Wohlgelegen, Germany, assignor to the Firm of Rhenania Verein Chemischer Fabriken Actien-Gesellschaft, Zweig-Niederlassung Mannheim, Mannheim-Wohlgelegen, Germany.—1,588,868.

Process of Quick Tannage by Means of the One-Bath Method. Franz Merkel, Offenbach-on-the-Main, Germany, assignor to Chemische Fabrik Griesheim - Elektron, Frankfort - on - the - Main, Germany. — 1,587,019.

Extraction of Cellulose. Edgar Raymond Clark, Pittsburgh, Pa., assignor to Milton S. Erlanger, New York, N. Y.—1,587,631.

Process of Making Cellulose Derivatives. Leon Lilienfeld, Vienna, Austria. — 1,589,607.

Apparatus for Extracting Rosin and Turpentine from Wood. McGarvey Cline, Jacksonville, Fla.—1,589,837.

Nitrocellulose Composition. Edwin R. Littmann, Terre Haute, Ind., assignor to Commercial Solvents Corporation, Terre Haute, Ind.—1,589,608.

Nitration Process. Marion B. Hopkins, Elizabeth, N. J., assignor to Standard Development Company.—1,588,027.

Explosive Mixture. Allen E. Scott, deceased, late of San Francisco, Calif., by Edmund Nelson, executor, Oakland, Calif. —1,589,237.

Explosive. Walter O. Snelling, Allentown, Pa., assignor to Trojan Powder Company, New York, N. Y.—1,588,277.

Method of Partially Oxidizing Gaseous Hydrocarbons. Joseph Hidy James, Pittsburgh, Pa., assignor to Clarence P. Byrnes, trustee, Sewickley, Pa.—1,588,836.

Inorganic Processes

Manufacture of Titanic and Zinc Compounds. Pierre Pipereaut and André Helbronner, Paris, France.—1,590,697.

Process for Making Anhydrous Zinc Chloride. Niels C. Christensen, Salt Lake City, Utah.—1,590,229.

Treatment of Barium Peroxide for Obtaining Peroxide of Hydrogen and an Improved "Blanc Fixe." Isaac Ephraim Weber, Luton, England, assignor of one-half to B. Laporte Limited, Luton, England, a British Company, and of one-fourth to Horace Edward Alcock, Luton, England.—1,587,450.

Process of Treating Boron-Containing Minerals. Andrew Kelly, London, England, assignor to Borax Consolidated Limited, London, England.—1,590,099.

Zirconium-Oxide Compound and Method of Making Same. Charles J. Kinzie, Niagara Falls, N. Y., assignor to The Titanium Alloy Manufacturing Company, New York, N. Y.—1,588,476.

Separation of Sodium Chloride from Mixed Salts. Clinton E. Dolbear, Pasadena, Calif.—1,589,519.

Process of Treating Phosphate Material. Henry Blumenberg, Jr., Los Angeles, Calif., assignor to Stockholders Syndicate, Los Angeles, Calif.—1,588,651.

Production of Calcium Arsenate. Henry M. Schleicher, Boston, Mass., assignor to American Metal Company Ltd., New York, N. Y.—1,588,499.

Insecticide and Process of Preparing the Same. Edouard Horace Siegler, Takoma Park, and Charles Holcomb Popenoe, Silver Spring, Md.—1,589,866.

Fungicide. William Moore, Chappaqua, N. Y., and Cornelius D. Vreeland, Vineland, N. J.—1,587,977.

Process of the Manufacture of Gas. Morris William Travers, London, and Frank William Clark, Lymm, England, assignors to Regenerative Coal Gasification System, Limited, Manchester, England.—1,587,564.

Method of Recovering Ammonium Sulphate. Frank F. Marquard, Clairton, Pa.— 1,589,809.

Purification of Gases for Ammonia Synthesis. Georges Claude, Paris, France, assignor, by mesne assignments, to Lazote Inc.—1,589,628.

Catalyst for Synthesis of Ammonia. Ivar Walfrid Cederberg, Lidingo-Brevik, near Stockholm, Sweden, and Mikal Fjellanger and Vilhelm Gruner, Skoien, Norway, assignors to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania, Norway. — 1,589,682.

Method of Producing Hydrogen. Claude C. Van Nuys, Cranford, N. J., assignor to Air Reduction Company, Incorporated. — 1,588,860.

Production of Oxygen-Free Nitrogen. Floyd J. Metzger, New York, N. Y., assignor to Air Reduction Company, Incorporated, New York, N. Y.—1,588,258.

Base-Exchange Silicate and Process of Making it. Harold Joseph Wheaton, Lower Walton, near Warrington, England, assignor, by mesne assignments, to American Doucil Company, Philadelphia, Pa. — 1,586,764.

Process of Recovering Calcium Carbonate from Caustic Liquors. George A. Richter and Sanford L. Swasey, Berlin, N. H., assignors to Brown Company, Berlin, N. H. —1,587,679.

Process for Refining or Treating Sulphur. William P. Thornton, Park Ridge, Ill.— 1,586,539.

Method of Treating Limestone. Frank C. Mathers and Herman T. Briscoe, Bloomington, Ind.; said Briscoe assignor to said Mathers.—1,588,253.

Process of Concentrating Nitric Acid in a Column. Willi Büsching, Halle, Germany. —1,590,494.

Art of Recovering Sulphur Dioxide from Gases with Which it May Be Associated and Apparatus Therefor. Augustus H. Eustis, Milton, Mass.—1,589,133.

Chlorine-Containing Solutions. John H. Wright, Montclair, N. J., assignor to Zonite Products Company, New York, N. Y. — 1,588,288.

Method of Reclaiming Spent Pickling Solutions. Henry S. Marsh and Ralf S. Cochran, Youngstown, Ohio, assignors to American Copperas Company, Youngstown, Ohio.—1,589,610.

Apparatus for Producing Sulphurous Acid Gases. Ingenuin Hechenbleikner, Charlotte, N. C., assignor to Chemical Construction Company, New York, N. Y.—1,590,622.

Production of Concentrated Nitric Acid from Waste Acids. Howard N. Lentz, Gibbstown, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del. —1,590,043.

Evaporation of Chlorine. Benjamin T. Brooks, Sound Beach, Conn., assignor to The Mathieson Alkali Works, Inc., New York, N. Y.—1,588,699.

Gas Purification. Walter H. Fulweiler, Wallingford, Pa., assignor to The U. S. I. Contracting Company, Philadelphia, Pa. — 1,589,749.

Electrolytic Cells and Processes

Electrodeposition of Organic Materials on Anodes from Aqueous Emulsions Thereof. Carl L. Beal and Leon W. Eberlin, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y.—1,589,324.

Electrodepositing Organic Material Such as Rubber Upon Porous Objects of Non-conducting Material Such as Fabrics. Samuel E. Sheppard and Carl L. Beal, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y. — 1,589,325.

Electrodeposition of Organic Materials such as Rubber and Cellulosic Compounds. Samuel E. Sheppard and Carl L. Beal, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y.—1,589,326.

Electrodeposition of Coatings of Cellulosic Compounds. Leon W. Eberlin and Carl L. Beal, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y.—1,589,327.

Aqueous Emulsions of Electrodepositable Cellulosic Compounds and Coalescing Agents Therefor. Leon W. Eberlin and Carl L. Beal, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y.—1,589,328.

Process of Electrodepositing Rubber upon a Metal Wire. Samuel E. Sheppard and Leon W. Eberlin, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y.—1,589,329.

Aqueous Emulsion Containing Electrodepositable Rubber and a Cellulosic Compound. Samuel E. Sheppard and Leon W. Eberlin, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y. — 1,589,330.

Electrodeposition of Coatings Comprising Rubber and a Cellulosic Compound. Samuel E. Sheppard and Leon W. Eberlin, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y.—1,589,332.

Electrode for Electrolytic Decomposition Apparatus. Carl Fredrik Holmboe, Ris, Vestre Aker, Norway, assignor of one-half to De Nordiske Fabriker De-No-Fa, Oslo, Norway.—1,588,579.

Electrolytic Recovery of Metals from Solutions. Urlyn C. Tainton, Johannesburg, Transvaal, South Africa.—1,587,438.

Electrolytic Coating Apparatus. Austin H. Hart, Montclair, N. J., assignor to Rome Radiation Company, Inc., Rome, N. Y. — 1,587,303.

Process of Plating with Chromium. John Merle Hosdowich, Jersey City, N. J., assignor to Chromium Products Corporation, Wilmington, Del.—1,590,170.

Chromium Plating. Kevie Waldemar Schwartz, New York, N. Y., assignor, by mesne assignments, to Chromium Products Corporation, Wilmington, Del.—1,589,988.

Joint Working of Flames and Arcs and Apparatus Therefor. George Thompson Southgate, Anniston, Ala.—1,587,197.

Chemical Engineering Equipment

Rock Crusher. Charles B. Rogers, Joplin, Mo.—1,587,085.

Pulverizing Mill. Louis C. Bonnot, Louisville, and William M. Barker, Canton, Ohio, assignors to The Bonnot Company, Canton, Ohio.—1,589,740.

Grinding Mill. Kristian Middelboe, Frederiksberg, Copenhagen, Denmark, assignor to F. L. Smidth & Co., New York, N. Y.—1,589,302.

Disintegrating Apparatus. Joseph E. Kennedy, New York, N. Y., and Leigh A. Hunt, Lawrence, Mo.; said Hunt assignor to said Kennedy.—1,587,653.

Mixing, Disintegrating, or Homogenizing Machine. Harold E. Austin, Louisville, Ky., assignor to American Creosoting Company, Louisville, Ky.—1,587,063.

Rotary Drier. William A. Harty, Blasdell, N. Y., and Frank W. Moore, Thorold, Ontario, Canada.—1,587,727.

Apparatus for Drying Material. George A. Galloway, Chicago, Ill., assignor to B. F. Sturtevant Company, Hyde Park, Mass. —1,587,582.

Process of Drying Clays and Similar Materials. Thomas H. Rhoads, Philadelphia, Pa., assignor to Proctor & Schwartz, Incorporated, Philadelphia, Pa.—1,587,419.

Drying and Ventilating Method and Apparatus for Material-Drying Plants. Edward L. Hogan, Detroit, Mich., and George S. Witham, Jr., Hudson Falls, N. Y., assignors to American Blower Company, Detroit, Mich.—1,588,834.

Tunnel Kiln. Arthur McDougall Duckham, London, England.—1,590,154.

Kiln. Frederick A. Secord, Portland, Me., assignor of one-third to Charles Henry Peters and one-third to Alexander Pierce Paterson, both of St. John, New Brunswick, Canada.—1,587,041.

Rotary Distillation Retort. Harald Nielsen, Muswell Hill, London, England. — 1,589,417.

Design and Operation of Coke Oven. Arthur Roberts, Evanston, Ill., assignor, by mesne assignments, to Chicago Trust Company, trustee, Chicago, Ill.—1,588,469.

Evaporator. Martin J. Kermer, Evanston, Ill.—1,588,029.

Rotary-Drum Filter. Arthur Wright, Upper Montclair, and Frank W. Young, Verona, N. J.—1,590,401.

Extraction Process and Apparatus. William Frederick Holzheuer, Hale, Mich.— 1,587,646.

Continuous-Absorption Apparatus. Richard Tiedtke, Hochst-on-the-Main, and Jacob Benz, Niedernhausen a/Taunus, Germany, assignors to Farbwerke vorm, Meister Lucius & Bruning, Hochst-on-the-Main, Germany.—1,590,266.

Gas-Manufacturing Machine. Clarence F. Adams, Dayton, Ohio.—1,588,153.

Coke-Oven-Damper Valve. James McIntosh, North Braddock, and John W. Miller, Clairton, Pa.—1,587,972.

Briquetting Process. William Tyrrell, Seattle, Wash.—1,588,823

News of the Industry

Rubber Technologists Plan Big Symposium

Eminent Authorities Will Discuss Topics Bearing on Rubber Problems

At the Philadelphia meeting of the American Chemical Society, September 9-10, 1926, the Rubber Division is to hold a symposium on Raw Rubber. Leading rubber technologists and executives of the industry will reveal raw rubber developments, including scientific progress in the plantation rubber industry, in wild rubber, South American and African; and in synthetic or artificial rubber, to perfect which commercially scientists of all civilized nations are uniting in a common attack.

Rubber as a national asset, substitutes for rubber, the physical structure of rubber, the examination and testing of rubber, and guayule rubber, its botany, chemistry and technology, will be other topics.

A notable feature of the symposium, indicating, it was said, the battle is bound to ensue between synthetic rubber and the plantation product, and in which the plant biologist will be the synthesist's chief foe, will be a comparison of the physical properties of raw rubber with those of compounded vulcanized rubber.

There is probably some difference of opinion, chemists hold, as to whether or not it can be claimed from the commercial standpoint that crude rubber has been synthesized successfully. During the war as much as 40 tons per month of a product designated as synthetic rubber were manufactured, but the material was said to be satisfactory only for hard-rubber articles.

Enormous savings possible through reclaimed rubber will also be discussed. With the advent of the balloon tire the consumption of new rubber has become so great that if even a part of the new rubber can be replaced by new tires immense economies can be effected, it is declared.

The basic idea of the Philadelphia symposium, planned as one of the chief science gatherings of the Sesquicentennial International Exposition, is, according to Chairman Bierer, to present new facts and ideas, and not to review work already known, and information which is common knowledge or which can readily be obtained elsewhere. The promise of new facts and original ideas indicate the importance of the symposium.

Leading executives of the American rubber industry will attend a banquet of the Rubber Division on Thursday evening, Sept. 9.

Establishment of a Nitrogen Institute Discussed

Establishment of a nitrogen institute is under discusson. Plans have not emerged from the conversational stage but ideas are running along the lines followed so sucessfully by the Chlorine Institute.

Fixed nitrogen and ammonium sulphate producers realize that the time has come when definite steps must be taken to find new uses for nitrogen and to expand the old uses. Increased use of ammonium sulphate fertilizer to displace an imported material depends upon education, it is recognized. This would be one of the activities of the proposed institute.

Briefs Will Be Submitted in Magnesite Case

Briefs will be submitted to the Tariff Commission July 19, by parties at interest in its investigation of the costs of producing crude magnesite and caustic calcined magnesite, a public hearing in which was held June 21 and 22.

Owing to the fact that there are so few domestic producers and the further fact that most of the foreign costs were secured in confidence, the hearing failed to bring into public view any comprehensive figure which would indicate the real differences in cost. Most of the testimony and argument therefore was devoted to figures on importations, rail and water freight rates, and comparability of the domestic and foreign product for use in stucco construction work.

Several consuming companies presented witnesses who testified that they used either the domestic or foreign product with equally good results, despite some differences in color. One testified that he purchased about 25 per cent of his supply from importers at $2 per ton above what he paid for the domestic magnesite, merely to have assurance of two sources of supply.

The case before the Commission is the result of application for a higher duty filed by the Sierra Magnesite, Company, Porterville, Calif., and C. S. Maltby, San Francisco. H. A. Golwynne and Innes, Speiden & Co., both of New York, the principal importers of magnesite, opposed an increased duty, being represented by W. G. Merritt, of New York, as counsel.

Annual Meeting of Engineering Educators at Iowa

The Society for the Promotion of Engineering Education held its 34th annual meeting at the State University of Iowa, Iowa City, June 16-18. The papers and discussion were unusually virile and stimulating, with the result that the convention was regarded as the most fruitful held in recent years. Among the principal topics of discussion were the guidance of high school students in choosing engineering as a career, the elimination of unqualified engineering students, the methods of administering extension and co-operative courses and the qualifications of teachers.

The most important single feature of the convention was the report of the Board of Co-ordination and Investigation under the direction of Mr. Wickenden. The report indicated that the present four-year course of engineering instruction can be simplified and coordinated in such a way as to give a good general training upon which graduate study, extension courses, or postscholastic education can be built. The report recognized the fact that the engineer of today must not only be thoroughly trained in one field but broadly intelligent in allied fields.

Officers were elected for the coming year as follows: O. M. Leland, Dean of Engineering, University of Minnesota, president; H. W. Tyler, Massachusetts Institute of Technology and W. S. Rodman, University of Virginia, vice-presidents; F. L. Bishop, Dean of Engineering, University of Pittsburgh, secretary; W. O. Wiley, treasurer; Miss Sada A. Harbarger, Ohio State, W. K. Hatt, Purdue, E. R. Hedrick, University of California, R. A. Seaton, Dean of Engineering, Kansas State Agricultural College, J. W. Votey, University of Vermont, and S. M. Woodward, State University of Iowa, council. The next convention of the society will be held at the University of Maine, Orono, Maine.

Starch Dust Regulations Are Formally Approved

Regulations designed to prevent dust explosions in starch factories, which were tentatively adopted a year ago by the National Fire Protection Association, were formally approved as a standard of the association at its recent annual meeting. Previous conventions have adopted similar rules for pulverized fuel plants, sugar and cocoa pulverizing, and certain dusty agricultural industries.

Annual Meeting of Society for Testing Materials

Technical Papers, Rosin Symposium and Business Matters Featured

The twenty-ninth annual meeting of the American Society for Testing Materials was held at Atlantic City, June 21-25. The meeting was featured by the presentation of numerous papers bearing on the results of tests made to determine useful qualities of materials.

T. H. Nelson, in "Recent Developments in the Use and Fabrication of Corrosion-Resistant Alloys," told of a very large-scale application of chromium low carbon steel for tank construction and other structural work in a nitric acid plant for the du Pont company. Experience with rivets indicated that there is a tendency for the edge of the hole under the shop head to cut into the head, resulting in weakness unless the hole is countersunk and the rivet filleted. F. N. Speller, of the National Tube Co., remarked that men of the oil industry have declared they will be interested in stain-resisting steel when its price gets down to the neighborhood of 40c. per lb.

In the field of paints and oils the following papers were presented: "Hiding Power of Pigments," by R. L. Hallett of the National Lead Co., which indicated that there may be a relationship between hiding power and tinting power of white pigment; "The Study of Nitro-Cellulose Lacquers by the Stress-Strain Method," by G. W. Rundle and W. C. Norris, which gave extensive data on a study as yet only begun, indicating remarkable and distinctive effects of different plasticizers on such lacquers, as measured by the distensibility of films of lacquer; "Mechanical Testing and Recording of the Drying of Paints and Varnishes," by J. M. Sanderson; and "Accelerated Weathering, Further Developing of Apparatus and Exposure Cycles," by H. A. Nelson, F. C. Schmutz, and D. L. Gamble.

No less than 12 papers were presented in a symposium on rosin, which is discussed elsewhere in this issue.

Retiring president W. H. Fulweiler, chemical engineer, United Gas Improvement Co., addressing the meeting on "The Importance of Little Things in the Standardization of Methods of Testing," gave unusually valuable warning as to the care needed in the practical application of the testing art, both in the writing of specifications and in their execution. It is reproduced in abstract on another page of this issue.

A new standard specification for cement was adopted by the meeting to be sent to letter ballot. This will be canvassed about the 1st of August and if accepted will become the standard of the American Society for Testing Materials at that time.

Corrosion effects formed the central feature also of a paper by Prof. S. W. Parr and F. G. Straub, "The Cause and Prevention of Embrittlement of Boiler Plate." Long studies have been made by them at the University of Illinois to determine the nature of the action which makes certain boilers brittle and has led to many boiler failures. They find caustic soda in the boiler water to be responsible; it sets up a severe intercrystalline corrosion leading to the development of cracks and extensive loss of ductility of the metal. The phenomenon has been under study for more than ten years. Well waters in some regions of the Middle West and Southwest are responsible, and the alkali-producing effect of water softening treatment is involved in many cases.

J. H. Gibboney, of Roanoke, Va., chief chemist of the Norfolk & Western R.R. was elected president of the society, and Gustave W. Thompson, of New York, was elected vice-president. C. M. Chapman, W. F. Edwards, W. B. Price and H. T. Shelley are the new members of the executive committee.

One or two administrative changes of some importance were recommended by the executive committee and were approved by the society at the meeting. These include publication of the triennial book of standards in two sections, each member to be furnished with only one of the two sections and to have the privilege of purchasing the other. The institution of Student Membership was also authorized. Finally, the establishment of a permanent fund by the management of the society was approved, this fund to be accumulated through special but informal annual subscriptions to be collected from corporations specially benefited by the work of the society.

Russell Greenman retired as chairman of the committee on cement after nearly 10 years of service. His place as chairman is taken by P. H. Bates, U. S. Bureau of Standards. The new secretary, succeeding R. B. Young is F. H. Jackson, U. S. Bureau of Public Roads.

New Laboratories for Canadian Research in Pulp and Paper

A step of immense importance to the pulp and paper industry of Canada was taken at a recent meeting of the Canadian Pulp and Paper Association, in Montreal, when it was definitely decided to erect laboratories for scientific and technical research relating to pulp and paper and allied products. The building will be erected on the site of the present Forest Products Laboratories, abuting on the campus of McGill University, in Montreal.

This decision represents the culmination of much thought and effort expended on this subject by the Pulp and Paper Association, the Government and the University during the last ten years. The Association has formed a corporation which will donate the sum of $350,000 for the erection and endowment of the building. The building will form the executive headquarters of the Canadian Pulp and Paper Association and of the Division of Pulp and Paper of the Forest Products Laboratories. There will also be housed in it, as a separate independent unit, the Department of Industrial and Cellulose Chemistry of McGill University in which fundamental research in Cellulose Chemistry is to be carried out under the direction of Prof. Harold Hibbert, holder of the Chair of Industrial and Cellulose Chemistry at McGill University.

Lack of Finances Affect Alien Property Investigation

Although the Senate within three hours of the end of its session on July 3 adopted without discussion a resolution providing for the appointment of a special committee to make a sweeping investigation into affairs affecting the office of the Alien Property Custodian, the committee is confronted by the important difficulty of lack of finances at the outset of its work.

After securing adoption of the resolution, Senator King, democrat of Utah, its author, subsequently secured an amendment by unanimous consent providing that the expenses should be paid from the contingent fund of the Senate. When the committee met to outline its work July 7, however, there was brought to its attention a law that expense vouchers cannot be paid unless the resolution authorizing the expenditures specifies a definite amount which cannot be exceeded without vote of the Senate. Means are being sought to finance the preliminary work of the committee legally, but at the moment members of the committee are at a loss as to how far to proceed until Congress reconvenes and the defect in the resolution is corrected.

Senators Borah of Idaho, McMaster of South Dakota and Metcalf of Rhode Island, republicans, and Senators Bratton of New Mexico and Stephens of Mississippi, democrats, comprise the special committee. If possible, it is planned to employ experts to go over the books of the Alien Property Custodian, and then to have hearings start late in September, but the fund problem may delay all work.

The resolution is sufficiently broad to enable the committee to go into all matters in relation to the handling of alien property. It specifies especially an inquiry into the sale of patents and trademarks to the Chemical Foundation, Inc., and into the sale of properties of the Bosch Magneto Co. The committee plans an inquiry from the beginning of the office to date.

Bill for Labeling Caustic Shipments Not Acted On

Final action was not taken in the House on the bill proposing strict labeling requirements for all caustic and corrosive acids and alkalis. Shortly before the close of the session, however, the Interstate and Foreign Commerce Committee reported the bill favorably. It had been hoped that the bill would be held in committee until an agreement could be reached under which the labeling requirements could have been limited to lye and lye products. The purpose of the measure was to safeguard the public from accidental injury which in the great majority of cases is said to come from lye. Objection is made to the bill by the chemical industry on the ground that as now worded it covers a long list of chemicals that rarely are the cause of injury.

Assurances have been given representatives of several interested trade associations that the bill would not be reported until a substitute had been submitted.

News from Washington

By Paul Wooton
WASHINGTON CORRESPONDENT OF *Chem. & Met.*

OPPOSITION of such a determined type was encountered when Senator Borah, near the end of the recent session of Congress, brought forward his proposal to ratify the Geneva protocol intended to prohibit the use of gas in warfare, that the effort quickly was abandoned. This does not mean that the effort will not be renewed at the December session, but it does indicate that ratification will not be secured without a hard fight.

The opposition is being led by Senator Wadsworth, of New York, and Senator Reed, of Pennsylvania. While the discussions of the protocol have been behind closed doors, it is known definitely that the opposition is far from perfunctory in character. In fact both of the senators mentioned are outspoken in their hostility to the measure. They are wondering if anyone seriously doubts that use will be made of the gas weapon by any belligerent who may be hard pressed. Despite the altruism, of which the United States boasts, the opinion is expressed that any patriotic military leader would make use of gas, treaty or no treaty, if he believed it would rid the country of an invader who might not be stopped otherwise.

The coupling of bacteriological methods of warfare with war gases in the same protocol is thought to have been a deliberate effort to classify the use of chemicals with the poisoning of wells.

Theodore Burton, who headed the American delegation at the Geneva conference, admits that the protocol was brought forward by the Americans in the face of opposition from the Secretariat of the League of Nations. It is known, however, that the American delegation was divided as to the wisdom of the course urged by its leader.

One of the arguments which is being used effectively against the protocol is that a nation like Russia, which is not a party to the treaty, would be encouraged to take advantage of that fact and feature chemical warfare in its preparations. Another is to the effect that popular feeling toward the use of gas in war is influenced to a considerable extent because of the fact that it was used by the Germans. The introduction of gas in violation of a treaty and at a time when the feeling against the Germans was at its height created an impression which cannot be erased readily from the public mind.

Much significance is attached to the Treasury Department analyzed the principal two bids for Muscle Shoals and their comparison with the bid submitted previously by Henry Ford. By this impartial study an example is set which is likely to be followed frequently by committees of Congress in the future.

Had the trained actuaries of the Treasury Department analyzed the Ford bid and the other offers that have been made for the government's Muscle Shoals properties, many of the wild claims made by members of the Senate and by members of the House could have been refuted immediately. Even the committees themselves have been guilty of great inaccuracy in some of the conclusions they have drawn from financial setups.

The Treasury Department's financial analysis of the various offers is summarized as follows:

DAM NO. 2, DAM NO. 3, AND STEAM PLANT, ALL FULLY EQUIPPED

	Associated Power Cos.	Air Nitrates Corporation	Henry Ford
I. Without Headwater Storage			
Present worth of future payments	$54,627,610	$45,832,283	$45,986,482
Interest return to U. S. on its total investment of $80,772,341 per cent	3.252	2.828	2.798
II. With Headwater Storage			
Present worth of future payments	$78,695,930	$45,832,283*	$45,986,482
Interest return to U. S. on its total investment of $80,772,341 per cent	4.432	2.828	2.798

*The offer of the Air Nitrates Corporation or Henry Ford does not provide for any increased return to the United States for headwater storage.

Certain interesting facts develop from this analysis:

1. The offer of the Air Nitrates Corporation returns but 2.828 per cent on the investment of the United States, and not 4 per cent as has been the common understanding.

The offer of the Air Nitrates Corporation is worded so that a reader is lead to believe it provides 4 per cent interest return to the U. S., on its investment. But, the bidder stipulates that this is to apply to the expenditures made by the U. S. reduced by all amounts expended prior to May 31, 1922, or $20,738,404. That is, bidder asks deduction of 41.7 per cent of the total of $49,734,335 expended by the United States up to date. The effect of this deduction of capital and the arrangement of deferred payments is that the offer will return only 2.828 per cent on the total investment that the United States must make to carry out the contract.

2. The Air Nitrates offer provides no payments beyond this 2.828 per cent. There can be no possible retirement of the capital investment by the United States, or of any part of it.

The Air Nitrates offer is worded to create the impression that in additon to 4 per cent interest return a fund will be created to pay back to the United States the total investment within one hundred years. The Treasury analysis clearly shows that only 2.828 per cent interest will be received on the investment, and that no money would be available to repay any of the principal.

3. The offer of the Air Nitrates Corporation is nearly the same as the Henry Ford offer.

The Ford offer on a 50-year basis returns 2.798 per cent, whereas the Air Nitrates offer returns 2.828 per cent. It is noticeable that the bidder carefully calculated his payments to have an offer "as good as the Ford offer," and but slightly better.

4. The Associated Power Companies offer returns 3.252 per cent interest on the total investment, if no headwater storage is constructed; and 4.432 per cent interest if headwater storage is constructed in 10 years.

The Associated Power Companies offer, even if no storage dams are ever constructed, is better than the Air Nitrates offer by the difference between 3.252 per cent return and 2.828 per cent. If headwater storage is constructed in ten years, the Associated Power Companies offer is better by the difference between 4.432 per cent and 2.828 per cent.

5. The Associated Power Companies offer, if headwater storage is constructed in ten years, will return 4 per cent interest to the United States on the yearly balances of the total investment, and in addition repay to the United States $66,015,946 or 81.7 per cent of the inital investment. This is within the fifty-year lease period, at the end of which time the United States will also have returned to its possession the entire power properties.

Plans for the preparation of a report to be made to the Interstate Commerce Commission not later than August 14, were formulated by the Tank Car Committee of the Manufacturing Chemists Association at a meeting in Atlantic City, July 7, 8 and 9.

The Commission proposes to publish tank car specifications in tariff form. It is the plan of the Commission to give the force of law to the existing American Railroad Association specifications.

Tank cars used by the chemical industry usually are of special design and must make use of unusual appliances. Heretofore, special permits have covered these departures from the general practice. The committee will emphasize the need of protecting all these special permits. Some apprehension in this particular has been occasioned by an announcement on June 23 of the Bureau of Explosives to the effect the regulations should be confined to general principles, rather than to the enumeration and listing of every particular device and appliance. The formal hearing in this matter will be held in Washington Sept. 14.

The chemical industry has an investment of $25,000,000 in tank cars. They are used largely for the transportation of acids and compressed gases. The principal operators of tank cars in the industry are: The General Chemical Co.; The Barrett Co.; Semet Solvay Co.; Solvay Process Co.; National Aniline and Chemical Co.; Grasselli Chemical Co.; E. I. du Pont de Nemours & Co.; U. S. Industrial Alcohol Co.; Mathison Alkali Works; Merrimac Chemical Co.; Pennsylvania Salt Manufacturing Co.; Virginia Smelting Co.; Davison Chemical Co., and Hooker Electro-chemical Co. In addition, several other companies have from one to ten tank cars in use.

Coal Strike Has Not Yet Affected British Chemical Industry

Reduced Rate of Production, However, Soon May Be Necessary—Society of Chemical Industry Will Meet This Week

From our London Correspondent

THE COAL trouble still dominates the whole industrial situation, but so far, its effect upon the chemical industry has been small, chiefly because industries, such as iron and steel, were in a depressed condition before the strike. It is only now that the demand for chemical products will be increasingly and cumulatively affected and if there is no settlement, an equilibrium will gradually be established by the reopening of certain collieries, the importation of foreign coal and the capacity of bleachers, dyers and other important users to have at disposal sufficient power and fuel to carry on at a reduced rate of production.

Signs are not wanting that the end of the dispute is within sight and the middle of July is as good a prophecy at any other. The government plans for reorganization and a more scientific foundation, which has so long been urged, should be forthcoming very soon and already, there is considerable activity in connection with the Fuel Research Board, which is advertising for research chemists partly in connection with the physical and chemical survey of the national coal resources. Competent observers incline to the view that the ultimate solution will be the re-opening of the economic pits under the terms and conditions prevalent before the strike and that in the others there will be a lengthening of hours, combined with a slight reduction in wages in the exporting districts, and to some extent there should also be a closing of the unprofitable collieries, which would entail some unemployment and some transference of labor. This is a lesser evil than the increase in general unemployment which is already certain as a result of the effects of the strike hitherto.

Congress of Chemists

The other main topic of interest is the forthcoming annual meeting of the Society of Chemical Industry, which will be held in London, July 19-23 and is to take the form of a Congress of Chemists with the co-operation of all the leading institutions and organizations which are connected with chemical industry. A number of visitors are already announced from the United States, such as Dr. F. G. Cottrell, Prof. James Kendall and Dr. Ellwood Hendrick, while the Canadian Institute of Chemistry is represented by Lt. Col. L. F. Goodwin, professor of Chemical Engineering at Queen's University, Kingston. The meeting will to some extent be international in character, through the attendance of distinguished foreign delegates, and at the present time there is also a considerable influx of visitors from all parts of the Empire. For the first time, there will be a representative exhibition of British chemical plants, in which there has been considerable improvement during the last year, and manufacturers are beginning to realize that it is a paying proposition, even at a slight sacrifice in cost, to have available efficient organizations capable of supplying within reason the requirements of the chemical industry, instead of relying very largely upon continental suppliers for the latest types of plant. Earl Balfour, K. G., is to deliver the Messel Memorial Lecture and will probably select as the subject of his address the influence of chemistry and science upon trade and the efficiency of labor. Earl Balfour usually speaks extempore and the importance of the occasion should produce something more than usually worthy of the speaker, whose lecture, it is hoped, will be broadcast on the radio. The program of the meeting is very comprehensive and includes addresses by Sir Josiah Stamp and Sir Max Muspratt as well as conferences on corrosion, sugar from wood, power alcohol and others dealing with chemical engineering subjects. The new Fuel Section of the society is to be responsible for a summary on solid smokeless fuel, a subject which has rather been done to death, and which, it is felt, gives undue prominence to coke. A conference on the hormones—the natural drugs of the body—is sure to be full of interest, and very valuable work is being carried out at the present time as a natural corollary of what has been achieved with insulin.

An unusual and interesting feature in connection with the congress is the appointment of a publicity committee and this, it is felt, is a measure which has long been overdue, the lessons of publicity work carried out by corresponding organizations in the United States not yet having been adapted to British requirements. Most of the leading firms are lending their advertising space for announcements in connection with the congress and adequate press arrangements and a news service have been organized, and it will be interesting to note whether the results obtained will justify a continuation of a forward policy.

Industrial Notes and General News

Nobel Industries have had a good year and are paying an increased dividend on the ordinary shares and 5 per cent on the deferred shares. These results are partly due to a substantial holding in the General Motors Corporation and to careful and conservative finance and organization. The company's position is extremely sound and at least equally good results are probable next year. Brunner Mond & Co. have also done well under difficult circumstances and in spite of a payment of $5,000,000 to Lever Bros. in settlement of certain litigations, the details of which have not fully been made public. Courtaulds have made the interesting announcement that they are embarking on the manufacture of acetate silk and of course, it was known that they have for a long time been ready and able to do this efficiently as soon as such a policy could definitely be decided upon. Further progress is announced in regard to the new method of coloring cement and building materials, using fast organic dyestuffs. Specimens prepared by Dr. G. N. White were exhibited last week at the Annual Conversazione of the Institution of Civil Engineers and attracted much attention. It is stated that considerable improvement and simplification has already been effected and that arrangements for commercial exploitation both here and abroad are likely to be completed at an early date. Another very interesting exhibit at this conversazione was that of the Aerated Concrete Co., whose process of making "Aerocrete" is of particular interest in that it has a chemical foundation. "Aerocrete" consists essentially of rapid-hardening Portland cement or "Ferrocrete," to which a small percentage of aluminum powder has been added. When the gaging water is added, the aluminum reacts with the alkali in the cement and generates a slow stream of hydrogen, which converts the cement into a sponge-like mass, which on setting, may have a density less than that of water and yet possess considerable strength. Among the numerous advantages which accrue are the efficient keying to the mass of any cement rendering which is subsequently applied, lightness, heat insulating and sound resisting properties, easy manipulation and working and the fact that nails can be driven into the mass. A similar material is also being developed under the name of "Cell-crete," but in that case, compressed air is apparently used for producing a sponge-like structure. In both cases, it is claimed that the resultant mass is substantially waterproof.

Dyestuff Corporation Crisis

British Dyestuffs Corporation appears to be passing through something of a crisis, during which decisions of very far-reaching importance may have to be made. Rumor is, of course, still current in regard to conversations with the German Dyestuffs Trust and the falling off of demand through the strike has come at a moment when a definite turn for the better could otherwise have reasonably been expected. It is reported that one of their works has had to shut down, owing to lack of orders or fuel and this may lead ultimately to the concentration of manufacture and administration, with which a beginning has already been made by the concentration of the manufacture of vat dyestuffs at the works of Scottish Dyes.

Germans Place New Motor Fuel On the Market

A report from trade commissioner William T. Daugherty, Berlin, states that a new German motor fuel known as B. V. Monopolin, is being introduced on the German market by the Benzol-Verband, of Bochum. The new fuel is said to be a mixture of ethyl alcohol, with a grade of light gasoline and motor benzol.

France Is Increasing Production of Synthetic Nitrogen Compounds

Plant Has Just Been Put in Operation at Dourges and Another New Plant Will Start Production This Summer

From our Paris Correspondent

AT THIS writing Ammonia, which is a company comprising a group of collieries in Northern France, is preparing to begin operations in its new plant at Dourges. The company holds a license to use the Casale process.

In the same group another plant in with the Kuhlmann combine is interested, will be put into operation this Summer. This latter plant, erected mutually with the collieries of Anzin, is expected to provide the ammonia necessary for the production of synthetic nitric acid used by Kuhlmann at its plant of Wattrelos near Lille.

The balance sheet of the Kuhlmann company for 1925 shows a net profit of 24 million francs on a capital of 180 million francs. This combine, one of the biggest producers of our heavy chemical industry, had, in 1925, an output of 433,000 tons of superphosphates, 472,000 tons of mineral chemical products, and 8,727 tons of dyestuffs. The two first figures are an increase as compared with 1924. Dyestuffs, on the other hand, declined 300 tons from the total of 1924. This decrease is particularly obvious in synthetical indigo for which the Chinese market has been lacking. The manufacture of synthetic indigo (paste 20 per cent) has fallen off from 4,700 tons in 1924 to 3,700 tons in 1925.

Kuhlmann production of intermediates in 1925 shows development, 15 new products having been started. A first series of vat colors (brominated indigos) were put on the market during the year. The company has just finished preparations for manufacture of the vat colors derived from anthracene. During this year Kuhlmann hopes to turn out vat colors of this group and especially indanthrene violet and blue. On the other hand the necessary steps have been undertaken to double the production of sodium bichromate and sodium sulphide at the work of Wattrelos. The building of the plant for liquid chlorine has already begun at the work of Loos.

The potash mines of Alsace have just put into operation at their mine of Marie-Louise, near Staffelfelden, a new plant for the production of potassium chloride. Up to the present time there was only one plant operating at the mine of Amélie at Wittelsheim. This latter existed in 1912 but had been very seriously impaired during the war. After the war it had been partly reconstructed and renovated.

It is known that the potassium salts extracted from the Alsatian deposits are composed of sylvinite, that is a double sale of sodium and potassium chloride utilized under this form in agriculture. Sodium chloride is soluble in hot and cold water nearly in equal quantity while potassium chloride is very easily soluble in hot water and much less in cold. So if we dissolve sylvinite in hot water or in a common salt solution till saturation has been obtained, sodium chloride will separate and can be removed by filtration while potassium chloride remains in solution. In this state these solutions are let to rest in crystallization tanks so as to gather concentrated potassium chloride which is washed with water in order to rid the mother-liquors. The latter and also the crystallization waters are again used for the dissolution of new quantities of sylvinite. The potassium chloride thus obtained is then dried in rotary drums crossed by hot gases. The new plant of Staffelfelden is capable of turning out 120,000 tons of potassium chloride per year. This production will be reached in two year.

This concentrated salt is especially suited for the manufacturing of heavy soils at doses varying from 150 to 300 kilogr. per hectare. As it is equally good for any vegetable one sees immediately the profit of utilizing potassium chloride instead of sylvinite.

French consumption of potash salts is about 120,000 tons per year. Experts are of the opinion that France can absorb yearly 300,000 tons of potash or about treble the tonnage now consumed. Alsatian potash for the United States is principally shipped at Antwerp. In order to facilitate the shipping operations, the society of Alsatian Potash has decided to build important stores in the harbor of Antwerp allowing the storage of 500 tons of potash salts in an hour. A bagging tower will be erected where the potash is put in sacks. This tower 30 meters in height will permit the filling of 1,000 sacks of 100 kilogr. each in one hour. Two great silos are planned to permit the storage of 100,000 tons of potash.

Model Cottonseed Oil Mill Under Construction

A model cottonseed oil mill is now in course of construction at Garland, Dallas County, Tex., to be used as an experimental plant in ascertaining the actual costs of producing cottonseed oil. The plant will be equipped with every known labor-saving device and will be more replete, it is said, than any such mill in operation at the present time. With modern laboratory, every batch of seed that is run through the mill will be tested for oil content, and checked closely with amount of oil received from the presses. The mill will be electrically-operated and will have a rated capacity of 30 tons of cottonseed every 24 hrs. It will be operated day and night through the cotton season. With improved automatic equipment, one of the chief economies of the plant will be developed through necessity for minimum labor. The Garland mill is being built by the Western Engineering Co., and data secured through its operation will be made available for oil mill operatives at no cost; the mill and records of production will be open for inspection at all times. The plant is expected to be ready for service early in September.

News in Brief

Denaturing Formula Revised — The Treasury Department has announced that it has resorted to the use of gasoline as one of the materials necessary to completely denature alcohol. Charles R. Nash, acting Commissioner of Internal Revenue, declared that hereafter the denatured alcohol formula No. 2 in the Treasury's regulations would include gasoline at the ratio of one-half gallon of approved gasoline to each 100 gal. of denatured alcohol.

Dutch East Indies Increase Rubber Output—Production of crude rubber in the Dutch East Indies will probably amount to as much as 150,000 long tons a year by 1930, according to reports received at the Department of Commerce, on the basis of surveys of rubber production possibilities in that region. This amount would be about double the production of the East Indies last year.

Pulp and Paper Man Resigns from Legislature — Carrying out a pledge made about a year ago, Frank J. D. Barnjum, well known pulp and paper man, has resigned his seat in the Nova Scotia Legislature. During the campaign prior to the provincial elections on June 25, 1925, Mr. Barnjum pledged himself to resign his seat if a paper mill was not in course of erection in his constituency within one year. The paper mill was not erected.

Japan Will Prevent Dumping of Soda Ash and Ammonium Sulphate — Soda ash and ammonium sulphate are included in the list of commodities on which the Commission on anti-dumping, recently instituted by the Japanese Diet, will make investigations. The Diet approved an appropriation of 12,925 yen as the initial cost for the establishment of an anti-dumping investigation commission. The commission is empowered to deal with all matters concerning the prevention of dumping of foreign goods which compete with domestic industries.

Davison Chemical Co. Buys Three Plants—The Davison Chemical Co. has acquired the Eastern Cotton Oil Co., the Miller Fertilizer Co. and the E. H. & J. A. Meadows Co., a fertilizer company.

New Canadian Paper Company to Start Operations—It is announced by the Powell River Paper Co. of British Columbia that operations are to be started shortly by the first unit of the company's new plants—a 50-ton paper machine. When the present expansion plans, involving an expenditure of about $8,000,000 are completed, the Powell River Company will be turning out paper at the rate of between 450 and 500 tons of newsprint per day.

German Potash Industry Disturbed by Increased Output

Larger Production May Force Readjustment of Existing Quotas for Export Trade Between German and French Producers

From Our Berlin Correspondent.

THOUGH it was announced some time ago that, on April 11, 1926, the Franco-German Potash Pact had been renewed at Lugano, the French and German industries are by no means in agreement. The reason why so little is heard of their differences is that, when the trust was first formed, it was made a prime condition that neither side should make any pronouncements detrimental to the other's interests, so that, at all times, the appearance of absolute harmony between the two contracting parties should be preserved. A private conference, however, was held last month at Karlsbad to discuss outstanding differences.

The importance of these negotiations for the American chemical market can be made apparent from a few figures. In 1913, when the German Potash Trust owned all the potash mines of the world, the double zentner (220 lb.) of pure potash (K_2O) cost M. 18. In 1924, when the French and German potash industries were in direct competition, the double zentner cost only 13.80 marks, whereas again in 1925, after the re-formation of the trust, the price had risen to marks 15.50. As America is the chief consumer of potash, it is clear that negotiations among producers are of prime interest to that country.

The tension between the French and German mine owners is chiefly about "quotas." Until 1918, all potash mines were in the German Trust, but the restoration of Alsace to France brought a French potash industry into existence. The French government has spent vast sums in developing and stimulating its new industry—150 million francs were spent in 1922 alone when the franc stood at from 10 to 15 to the dollar. But the total number of potash shafts in Alsace is still only 18 and the number of reduction plants 5. The German mines number 224, of which 70 are in operation and 33 in reserve ready to reopen at any minute, while there are 40 reduction plants. Before the war, when the Alsatian mines were still German, their total output was about 58,000 tons of K_2O out of a total German output of 1,100,000 tons, or not more than 6 per cent. But the French devoted such intense energy to the development of their mines that, by 1923, the Alsatian shafts were producing 248,000 tons out of a combined total of 1,133,957 tons. The official German figures respecting sales of potash bear this out very clearly.

The striking facts are—that the total quantity of potash sold now is about the same as it was in 1913, while the increase in exports alone has not been very material. But whereas the proportion sold by the Alsatian mines in 1913 was only 6 per cent of the whole, it had reached 34 per cent by 1924. This represents the highest share of the total trade that the French mines could hope to win. The French government had subsidized the modernization of the Alsatian mines during years when the German mark was violently depreciating, and when consequently Germany had no capital with which to increase the efficiency of its mines at the same rate. The output of some of the Alsatian mines is now four times as great as it was. The German mark was stabilized in 1924, and the Germans then set about modernizing their mines also. That was the moment chosen by the French as most favorable for proposing the reconstitution of the trust, so that price-cutting might be abolished and prices raised by agreement.

Total Sales of K_2O

Year	Germany			France		
	Inland Dzs.	Foreign Dzs.	Total Dzs.	Inland Dzs.	Foreign Dzs.	Total Dzs.
1913	6,042,828	5,060,866	11,103,694	....	....	....
1924	5,024,600	3,396,003	8,420,603	960,000	1,750,000	2,710,000

Germany and France together:

	Total Sales	Total Export	French Proportion
1913	11,103,694	5,060,866	....
1924	11,130,603	5,146,003	34 per cent

After the high losses that resulted from the depreciation of the mark, the German potash owners were very glad to enter into a provisional agreement with the French for one year. This was signed in August, 1924, and split up the American market between Germany and France in the ration of 62½ per cent to Germany and 37½ per cent to France. This was revised on May 7, 1925, into a division of the world's markets outside of Germany, France and its colonies in the ratio of 70 per cent to Germany to 30 per cent to France.

These two agreements enabled prices to be raised considerably but they led to great discontent in Germany, because it meant that there ceased to be any incentive to modernize the German mines. Hence, when the terms of the new 10-year agreement reached in Lugano on April 8 were made known, there was widespread protest. The agreement was to be absolutely binding for 7 years, but could then be terminated if one year's notice had been given by either side before the end of the sixth year. If no notice had been given, the agreement was to run for the full 10 years and, after that, for further periods of 5 years. A further curious proviso was made about the quotas. Only if the total sales should amount to 840,000 tons K_2O, was the ration of division to be 70:30. But if sales only reached 825,000 tons, then Franch was to have a further special allowance of 3,000 tons, and after that, the division of the remainder should be in the ration of 70:30. Over and above 840.000 tons, foreign orders were to be filled half by France, half by Germany.

Why these figures regarding sales should have been chosen is not clear, because, in actual fact, the highest sales ever made by German mines were in 1925 when only 453,000 tons was exported. In 1924, the total exports of France and Germany together were only 514,600 tons, so there seems little prospect that the quantity named in the new contract, viz., 840,000 tons, will be reached for many years to come.

The situation with which the negotiators at Karlsbad had to deal is clear. France demands that the quotas should be settled by present output figures, which allots 30 per cent or more of the foreign sales to France. The German mines are now being rapidly modernized, and will soon be capable of producing altogether nearly ten times the Alsatian output. The Germans assert that the French quota should be based on the productive capacity when all mines have been thoroughly modernised. This would be equivalent to providing for a re-determination of the quotas. Needless to say, France will not give way on this point to any appreciable extent.

It is thought, however, that agreement might be reached in another way, It is argued that, with modernised works and increased output, prices may be considerably reduced, provided the potash produced can be sold. It is a question of finding markets for the increased output. The Alsatian mines are now working at their utmost capacity. If, therefore, by a joint and vigorous advertising campaign in America and in other great agricultural countries, farmers can be induced to use greater amounts of potash than heretofore, the increase would chiefly benefit the German mines and thus reconcile their owners to the high French quota.

There is another reason why both French and German owners sincerely want to reduce prices. The vote by Congress of funds for investigating the possibility of exploiting the Texas potash deposits has proved very disquieting in Europe. It is not thought possible that potash will be obtainable cheaply from Texas; nor that it will be obtainable at all on the commercial scale for at least another 5 years, but it is felt that the wisest way to discourage further experiments is to supply potash to America so cheaply that the Texas sources will be kept noncompetitive.

Magnesium Chloride Commands High Price in Germany

Consuming interests in Germany have registered a strong complaint concerning the increase in the price of magnesium chloride, which has advanced 200 per cent in less than two years. In explanation of the increase in price the magnesium chloride producers state that the increase has been brought about by a rise in the cost of magnesium chloride liquors.

Men You Should Know About

PAUL D. BARTON, president of the California Natural Gasoline Association, has resigned his position as manager of the gas department of the United Oil Company of Los Angeles. Mr. Barton is entering business as a consulting engineer and will also operate a number of his own plants for the manufacture of gasoline from natural gas. His address is 1734 Meridian Avenue, South Pasadena, Calif.

PAUL D. V. MANNING has joined the editorial staff of *Chem. & Met.* and will represent that journal on the Pacific Coast, succeeding A. W. Allen.

Paul D. V. Manning

His address is 1505 Ramona Ave., South Pasadena, Calif.

Prof. M. J. BRADLEY, formerly with the University of Illinois, is now assistant professor of chemical engineering at the University of Cincinnati.

D. B. BRADNER, recently consultant in the duPont organization has been appointed director of research for the Champion Coated Paper Co. and the Champion Fibre Company at Hamilton, Ohio.

Dr. HERBERT A. WINKELMANN, technical superintendent of the tire division of the B. F. Goodrich Co., resigned to assume charge of the chemical laboratories and development department of the Philadelphia Rubber Works, both in its Akron plant and subsidiary factories.

HOYT C. HOTTEL of Erie, Pa., has been appointed to the Research Fellowship in Gas and Fuel Engineering at M.I.T., established jointly by the Massachusetts Gas Co. and the Boston Consolidated Gas Co.

Dr. H. L. MAXWELL, heretofore connected with the Iowa State College, Ames, has been appointed associate professor in chemical engineering and associate in the engineering experiment station, Purdue University, Lafayette, Ind.

R. R. DANIELSON of Chicago, Ill., heretofore in charge of research in the enameling department of the A. J. Lindemann & Hoverson Co., Milwaukee, Wis., has accepted an appointment as director of research in the ceramic department of the Metal & Thermit Corp., with headquarters in New York.

A. L. HAWKES, executive vice-president of the General Chemical Co., New York, has resigned to become vice-president of Congoleum-Nairn, Inc., Philadelphia, Pa., in complete charge of company operations.

J. W. WHITTEMORE has been appointed director of a new department of ceramic engineering now being established by the Louisiana State University, Pineville.

Dr. ERNST COHEN, professor of physical chemistry at the University of Utrecht, Holland, and president of the International Congress of Pure and Applied Chemistry, is now visiting the United States and will remain in this country for a number of weeks. He will lecture at several universities.

Dr. HARRY M. GOODWIN, professor of physics and electrochemistry, M.I.T., has been appointed dean of graduate students. He was graduated from the Institute in 1890, and began teaching in the department of physics in the same year. He is now in charge of the course in electrochemical engineering in the department of physics.

GLENN GREEN, formerly assistant chemist in the City of Cleveland Sewage Disposal Division of the Engineering Department, and of the Kalbfleisch Corp., in Erie, Pa., is city chemist and superintendent of water filtration at Cambridge, Ohio. He and Mrs. Green have opened The Cambridge Laboratory recently for the purpose of contributing to the medical facilities of the vicinity.

W. J. BECK, director of research, The American Rolling Mill Co., Middletown, Ohio, has sailed for a three-months' trip throughout Europe. He will visit the industrial centers. He is accompanied by his wife and two sons, Charles and Calvin.

WILLIAM HUTTON BLAUVELT, consulting engineer of New York, sailed on July 3, on the S. S. "Caledonia" for a two months' trip to England, France and Germany to investigate work relating to the carbonization and processing of coal. Mr. Blauvelt will give especial attention to the new low temperature and hydrogenation processes.

NATHAN A. BOWERS, Pacific Coast Editor of *Engineering News-Record*, has received the degree of Doctor of Philosophy from Stanford University.

EDWARD V. PETERS, who for the past 7 years has been general sales manager of the N. J. Zinc Co., has resigned to become vice-president in charge of sales of the Tubize Artificial Silk Company of America.

Dr. HAROLD S. BOARDMAN was inaugurated the seventh president of the University of Maine, Orono, June 12.

Prof. T. MCLEAN JASPER of the University of Illinois, has joined the A. O. Smith Corp., of Milwaukee, to take charge of the company's research activities.

ALLEN ABRAMS, who has been chemist for the Cornell Wood Products Company at Cornell, Wisconsin, during the past five years, has resigned to become chief chemist for the Marathon Paper Mills Co. at Rothchild, Wisconsin, near Wausau.

Dr. DONALD B. KEYES, for some years director of research for and patent advisor to the U. S. Industrial Alcohol Co., located at Baltimore, Md., has

Donald B. Keyes

resigned and after September 1 will have charge of the courses in industrial chemistry and chemical engineering at the University of Illinois. He succeeds in this position Professor S. W. Parr, whose honorable retirement follows 35 years of distinguished service.

J. E. HANSEN has joined the research staff of the Ferro Enameling Co., Cleveland. Since June, 1920, he has been at the Mellon Institute engaged in research and development problems for both cast iron and sheet iron for members of the Stove Founders' Research Association.

AUG. C. ORTHMANN has been appointed chief chemist for the Pfister & Vogel Leather Co., Milwaukee, Wis. Mr. Orthmann has been with the company 18 years, 13 of which he has been assistant chief chemist.

Dr. FRANCIS L. SIMONS has joined the research staff of Skinner, Sherman and Esselen, Inc., of Boston.

B. G. POTDAR, after receiving his M.S. in chemistry from Cornell University in June, 1925, joined the Halcomb Steel Co. of Syracuse, N. Y. This month he expects to sail to Bombay, India, to take charge of the Pioneer Alkali Works, Ltd.

SIDNEY CORNELL has moved his office from 80 Maiden Lane to 7 Dey Street, New York.

J. H. TORRENCE, during the war supervisor of nitric acid manufacture for the duPont Co. at its Hopewell and Old Hickory plants, and since then identified with sales and production work in the chemical industry, has accepted a position as production superintendent for the Skenandoah Rayon Corp., located at Utica, N. Y.

T. S. C. HOWARD of London, England, who has been in this country for several months on business returned to England the latter part of June.

CULLEN W. PARMELEE, director of the department of ceramics, University of Illinois, received the degree of Master of Science at the 160th commencement of Rutgers University, New Brunswick, N. J., June 12. Prof. Parmelee was the director of the department of ceramics at Rutgers at the time of its inception in 1902.

E. P. WRIGHT, research assistant in the department of ceramic engineering, University of Illinois, Urbana, has resigned to join the Homer Laughlin China Co., Newell, W. Va.

H. G. MITCHELL, who for a number of years has been with the United States Industrial Alcohol Co., now has charge of the research work of the Speer Carbon Company, Saint Marys, Pa.

JAMES H. GIBBONEY, chief chemist of the Norfolk & Western Ry. Co., was elected president of the American Society for Testing Materials at its convention in Atlantic City, June 21-25.

Dr. NORRIS W. RAKESTRAW has been appointed assistant professor of chemistry of Brown University, in charge of the teaching of inorganic chemistry, and will handle the courses that were handled previously by Prof. H. F. Davison. Prof. Rakestraw spent the past year at Oberlin College where he was taking the place of Prof. Harry Holmes. Previous to that time he was located at Stanford University.

The New York Section of the AMERICAN ELECTROCHEMICAL SOCIETY, elected the following officers for the year 1926-1927: Chairman, Duncan McRae; vice-chairman, C. A. Phillippi; secretary, C. L. Mantell.

Professor EDWARD CURTIS FRANKLIN received the degree of Doctor of Science from the Western Reserve University, Cleveland, Ohio, at the commencement exercises on June 17, in recognition of his remarkable and outstanding research in the liquid ammonia system.

G. C. BETZ, heretofore instructor and research assistant in the ceramics department, Rutgers University, New Brunswick, N. J., has accepted a position with the Circle "F" Mfg. Co., New Brunswick and Trenton, N. J., effective July 1. He will be succeeded at the university by Malcolm B. Catlin, who has been abroad for the past year inspecting wall tile to be used in the Holland Tunnel for the New York State Bridge & Tunnel Commission and the New Jersey Interstate Bridge & Tunnel Commission.

Professor JAMES W. MCBAIN, of the University of Bristol, England, was the guest of honor at the Fourth National Colloid Symposium.

Calendar

AMERICAN CHEMICAL SOCIETY, Philadelphia, Pa., Sept. 6 to 11.

AMERICAN ELECTROCHEMICAL SOCIETY, Washington, D. C., Oct. 7, 8 and 9.

AMERICAN INSTITUTE OF CHEMICAL ENGRS., Atlanta, Ga., and Birmingham, Ala., Dec. 6 to 10.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING (5th) Grand Central Palace, New York, Dec. 6 to 11.

SESQUI-CENTENNIAL INTERNATIONAL EXPOSITION, Independence Sq., Philadelphia, Pa., June 1 to Dec. 1.

SOUTHERN EXPOSITION (2nd Annual), Madison Sq. Garden, N. Y., Oct. 2-10.

Obituary

Dr. CARNIE BLAKE CARTER, an industrial fellow of Mellon Institute of Industrial Research, University of Pittsburgh, met with death in a train wreck near Blairsville, Pa., on June 16. Dr. Carter, who received his professional education at the University of North Carolina had spent ten years in research in organic chemistry at the Institute. Since 1919 he was engaged in an investigation of the production of chemicals used in the manufacture of synthetic resins and made a number of important discoveries that have been patented.

JOHN H. EUSTACE, vice-president in charge of operation of the Peoples Gas Light and Coke Company died in May. On Mr. Eustace's seventieth birthday, February 15,1926, over five thousand of his fellow workers and business associates met at the Medina Temple, as a family party to express their esteem and affectionate regard for the man who for forty years had devoted himself to the task of building up the service. On this occasion he was presented with a handsomely engrossed testimonial, a solid platinum ring set with seven diamonds and a silver vase, suitably engraved. John Eustace was born in Vermont and first took service with the gas company in Rutland, Vt., in 1869. He never was in any other line of work and consequently served the gas industry for over fifty-six consecutive years. In 1897 he was made assistant chief engineer of The Peoples Gas Light and Coke Company, in 1903 he became chief engineer and in 1924, vice-president in charge of operation.

URI T. HUNGERFORD, brass manufacturer and financier, died at his home in New York, June 16, from the results of a severe cold. He had recently returned from a visit to Europe. His wife and a daughter survive. He was born December 14, 1841, at Torrington, Conn. After holding several positions he established the U. T. Hungerford Brass and Copper Company in New York in 1895.

FREDERICK S. SPIERS, secretary and editor to the Faraday Society, London, which he assisted in founding in 1903, died May 21 at the age of 50. In 1920 Mr. Spiers undertook in addition to his other work the secretaryship of the newly formed Institute of Physics. During the war he stimulated the formation of a Nitrogen Products Committee of the society, and as a result of the reports of this committee, in part drafted by him, important researches were carried out by the Munitions Inventions Department. He also organized, for the British Science Guild, the successful Exhibitions of British Scientific Products in 1917 and 1918. For his work in connection with the war he received the Order of the British Empire.

Industrial Notes

HILLS-MCCANNA CO., Chicago, has opened an eastern sales office in charge of F. R. Glenner, Room 704, 53 Park Place, New York City. Mr. Glenner will have charge of engineering and sales work on Hills-McCanna non-ferrous alloys and products for corrosion-resisting service, as well as the force feed lubricators and steam specialties manufactured by the company. A sales office has also been opened in Cleveland, Room 832, Guardian Bldg., in charge of Harry Hartling, who also has the territory of Ohio, Western New York and Western Pennsylvania.

The JEFFREY MANUFACTURING CO. of Columbus, Ohio, announces the election of Robert W. Gillispie as vice-president, assistant general manager and member of the Board of Directors. Mr. Gillispie was formerly with the Bethlehem Steel Co. in the executive sales work of that company.

JENKINS BROS., manufacturers of valves and mechanical rubber goods, held the sixty-second convention of salesmen and representatives from the United States, Canada, England, Cuba and Mexico, in commemoration of the sixty-second year of Jenkins Bros. business. The program included meetings at the executive offices in New York, trips through the bronze and iron valve factories at Bridgeport, Conn., and the Rubber Division at Elizabeth, N. J. A banquet at the Hotel Biltmore, New York, was tendered to over a hundred men of the organization, with Farnham Yardley, president, acting as toastmaster.

The CHEMICAL & VACUUM MACHINERY CO., INC., Buffalo, N. Y., has acquired from the Judelson Evapo-Dryer Corp., New York City, all rights to build and market exclusively the apparatus known as the Judelson Evapo-Dryer under Process Patent 1,527,193, Dryer Patent 1,527,192 and Insulator Patent 1,513,595.

HOMESTEAD VALVE MANUFACTURING CO., Homestead, Pa., has appointed the F. A. Herr Company, 360 Warwick Ave., Buffalo, N. Y., as a representative of the Homestead Valve Manufacturing Co. in the Buffalo and Rochester districts.

CHARLES C. PHELPS, 473 Getty Ave., Paterson, N. J., announces that he and Charles J. Schmid, his associate, have been appointed Metropolitan New York and Northern New Jersey representatives for the Uehling Instrument Co. of Paterson, the William Guage Co. of Pittsburgh, the Combustion Control Division of the A. W. Cash Co. of Decatur, Ill., and the National Boiler Protector Co. of Dayton, Ohio. Mr. Phelps still retains his former connection with Uehling as treasurer of that organization. Mr. Schmid was formerly the Boston representative of the Uehling Instrument Co.

GOLDING SONS' COMPANY, Trenton, N. J., has appointed G. G. Hanson of 2642 North Mozart Street, Chicago, Ill., as Western representative of this company and the Erwin Feldspar Co., Inc. He will represent the two companies in the sale of feldspar, kaolin, ball clays, sagger clays and Cornwall stone, in the States of Missouri, Kentucky, Illinois, Michigan and Wisconsin.

The ANDREWS-BRADSHAW CO., Pittsburgh, Pa., has appointed L. F. Kuhman vice-president and director. The company is the sales manager for the Tracyfier (Tracy steam purifier and Tracyfier gas and vapor scrubber). Mr. Kuhman has been associated with the company for the past three and a half years. For eight years prior to that time he was engaged as sales engineer for the Ingersoll-Rand Co., in the Pittsburgh district.

Market Conditions and Price Trends

Outside Competition Causes Changes in Shellac Industry of India

American and German Firms Are Importing More Raw Material for Manufacture from Bangkok and Singapore

DISCUSSION has been rife among members of the shellac industry of India relative to measures which should be adopted to safeguard the trade from inroads made by foreign competition. Trade commissioner Charles B. Spofford, Jr., in a report from Calcutta says conditions became so acute that the Indian Chamber of Commerce, Calcutta, has addressed a letter to the government of India, pointing out that the Indian shellac trade is threatened with a menacing competition from abroad where attempts are being made to manufacture shellac from seed lac imported from India and other sources.

Evidence in support of this claim may be found in the fact that exports of Indian seed and stick lac have increased from 7,631 hundredweight in the fiscal-year 1922-23 to 60,207 hundredweight in 1925-26, while imports into India of seed and stick lac from Bangkok and Singapore declined from 31,529 hundredweight in 1922-23 to 1,234 hundredweight in 1925-26. It is assumed that this increase in export of seed and stick lac from India and this decline in India's imports of seed and stick lac from Bangkok and Singapore has been due to importation by firms in America and Germany of the raw material for manufacture.

On April 1, 1926, the Indian government removed the 15 per cent ad valorem import duty on unmanufactured lac and this relief should not only enable Indian buyers to compete with other nations in the Singapore market but it should result in putting Burmese, Indian, and other stick lac prices on the same price parity, based on T. N. rates.

Export Duty In Prospect

Further, the Indian Taxation Committee in their report issued February 25, 1926, made the recommendation that "as regards new duties, one on lac, which is produced only in India, Indo-China, and Siam, and of which India enjoys a practical monopoly, is recommended." The Indian Chamber of Commerce in supporting the recommendation of the Taxation Committee claim that the prices of "Fines" and "Superfines" as also of the T. N. grades are at present too low to admit of renumerative production at the current prices of seed lac and that inasmuch as 80 per cent of the cost of manufactured shellac consists in the cost of raw material, a moderate export duty of 10 per cent on seed and stick lac would be likely to affect the competitive power of the foreign manufacture in relation to Indian shellac. However, no action is expected on this matter until next year.

Seed Lac and Shellac Prices

It may be pertinent to point out, however, that both the decline and the differential in seed lac and shellac prices appear to have remained proportionate in recent years. According to official customs returns, the average price of seed lac exported from India decreased from 205 rupees per hundredweight in 1922-23 to 118 rupees per hundredweight in 1925-26, or 42 per cent while the average price of shellac exported decreased from 242 rupees per hundredweight in 1922-23 to 138 rupees per hundredweight in 1925-26, or 43 per cent. Likewise, the differential in average prices of seed lac, 205 rupees per hundredweight, and shellac, 242 rupees per hundredweight, in 1922-23 was 15 per cent and the differential in 1925-26, seed lac 118 rupees per hundredweight; shellac 138 rupees per hundredweight, was 14.5 per cent. Moreover, the market price of shellac in Calcutta often fluctuates by as much as 70 or 80 per cent in the course of a year. No actual estimate of production is possible owing to the difficulty of obtaining reliable statistics of the stick-lac crop, and this uncertainty makes lac a highly speculative trade and leads to frequent fluctuation in the market values. It is doubtful whether an export duty of 10 per cent on unmanufactured lac could afford effective protection with shellac prices which fluctuated as is shown in the accompanying table.

The Indian Chamber of Commerce state in their letter to the Government that the possibility of a substitute for manufactured shellac may be entirely neglected.

Domestic Imports Increase

Imports of shellac into the United States during the present calendar year have been increasing over those for the corresponding period of 1925. Import values also have been lower. Total imports for the four-month period ended April amounted to 10,730,011 lb. valued at $4,734,964 as against imports of 5,841,368 lb. valued at $3,219,348 in the corresponding period of 1925. This indicates an average import price of 44c. per lb. for 1926 and 55c. per lb. for 1925. As prices for shellac in primary markets has been below the levels maintained a year ago it is difficult to tell whether recent lowering of average import prices has represented larger arrivals of the cheaper unmanufactured grades or is merely indicative of the decline in values for all grades which has characterized primary markets.

Arrivals of shellac at Calcutta in the period from January 1 to June 30, 1926 were approximately 10,900 tons. This represents an increase over arrivals for the corresponding period in 1925 when arrivals were 7,700 tons.

Imports of shellac into the United States for the last five calendar years offer the following comparisons of quantities and values:

Domestic Imports of Shellac

	Lb.	Value
1925	21,436,333	$11,433,671
1924	28,511,576	15,170,791
1923	32,775,176	20,034,540
1922	30,767,666	15,656,900
1921	23,871,866	16,634,073

Prices of T. N. Shellac in Calcutta per Bazaar Maund* from 1914-1923

	Highest		Lowest		Average
Year	Month	Price, Rupees	Month	Price, Rupees	Value, Rupees
1914	January	43½	October	23	0.3244½
1915	December	37½	July	23	0.3244½
1916	November	78	January	32	0.3244½
1917	April	100	October	58	0.3306
1918	December	100	May	83	0.3588
1919	December	185	April	70	0.4030
1920	January	255	April	155	0.3888
1921	May	170	February	90	0.2622
1922	April	205	October	135	0.2874
1923	January	185	July	115	0.3111

* Maund—82 pounds.

Indian Lac Exports and Imports for the Fiscal Years

Exports	1922–23 (Cwt.)	1923–24 (Cwt.)	1924–25 (Cwt.)	1925–26 (Cwt.)
Seed lac	4,734	19,100	35,129	37,424
Stick lac	2,897	1,800	6,494	22,783
Total unmanufactured	7,631	20,900	41,623	60,207
Button lac	18,387	16,863	21,612	21,678
Shellac	383,377	397,147	327,200	416,590
Other kinds	66,616	50,761	36,582	41,449
Total	476,011	485,671	427,017	539,924
Imports				
Seed and stick lac	31,529	21,782	8,238	1,234

Market Conditions and Price Trends

Outlook Favors Steady Movement of Chemicals in Current Quarter

Consuming Trades Less Active in May But Improvement Reported in June With No Slump in Prospect

ACTIVITY in basic industries of this country is reported to be unusually high. The Department of Commerce recently called attention to increases in the June business on the basis of statistics which showed the volume of check payments during the third week of June to be greater than in either preceding week, while the department's index of business was more than 4 per cent ahead of last year.

A report compiled by *Electrical World* and based on the monthly electrical energy consumption of some 1,700 large manufacturing plants in various industries scattered throughout the country states that industrial activity of the nation as a whole in June was 12.6 per cent greater than in the corresponding month last year. The returns received indicate that in June general industrial activity for the entire country in June was 17.1 per cent above the average monthly rate for the past three years, this figure having been corrected for seasonal variation and weighted in accordance with the importance of the various industries. The fact that in June of last year general industry was operating at only 4.5 per cent above the average monthly basis for the past three years but intensifies the prosperous condition of American industry today. In spite of many predictions to the contrary manufacturing activity failed in many instances to show the normally expected seasonal decrease, and in some instances the leaders actually reported a materially increased rate of activity over May.

A comparison of employment figures as reported to the Bureau of Labor would indicate that production and consumption of chemicals were smaller in May than in April. Comparing May with the corresponding period of last year, however, brings the deduction that material gains were recorded this year in the use of chemicals; the textile and rubber tire trades alone showing up unfavorably.

The Bureau of Labor index of employment in the chemical trade and in the principal chemical consuming trades shows the following:

WEIGHTED INDEX OF EMPLOYMENT

	May 1926	April 1926	May 1925
Dyeing and finishing textiles	97.3	99.7	100.6
Leather	89.3	91.1	87.9
Paper and pulp	96.4	86.1	95.1
Chemicals	94.1	95.7	90.7
Fertilizers	91.2	137.5	78.9
Glass	99.4	100.0	91.6
Automobile tires	107.8	111.6	115.9
Petroleum refining	98.8	98.9	91.1

The outlook for business in the third quarter of the year will, in general, continue in the same volume as for the corresponding period of 1925. This is the conclusion reported by 45 industries at the 11th regular meeting of the Atlantic States Shippers Advisory Board.

The members of the board base their forecast for the next three months on figures showing the actual number of freight cars which will be needed by specific industries to transport their products. The following industries look for a moderate increase:

Tobacco, slate, salt, petroleum and petroleum products, machinery, dairy products, cordage and anthracite coal. Less than carload traffic is also expected to show an increase. Business will continue the same during the next quarter, as compared with last year, for these industries:

Automotive parts, brick, canned goods, chemicals, clay products, copper, fertilizer, hides and leather, iron and steel, paper and pulp, and roofing materials.

Particular interest was shown in the report of the cement industry, which commented in its report on the slackening pace of building construction now being carried on. Future prospects, however, were described as good.

Adverse weather conditions have interfered with outside work and the output of paints, oils, and varnishes in the coming quarter will be reduced accordingly but a big improvement is looked for in the latter part of the year.

Shipments for July, August and September this year are expected to exceed shipments for the same period of 1925 by approximately 20 per cent.

Shipments of cotton piece goods, oil cloths, linoleums and pile fabrics are expected to show a slight increase in the next quarter over the same quarter of 1925. Shipments of felts and natural silk are expected to show a decrease of from 5 to 10 per cent. No material change is looked for in the shipment of cotton yarns, bleached goods, carpets and rayon silk.

Manufacturing Down in May

Manufacturing output in May declined from the high record of the preceding month, the May index showing no change, however, from a year ago, according to the monthly statement of the Department of Commerce. Declines from the previous month were recorded in textiles, iron and steel, lumber, leather, and paper and printing, while increases over April were made in foodstuffs, stone and clay products, non-ferrous metals, and tobacco products. Compared with last year, increases were noted in the output of foodstuffs, iron and steel, paper and printing, stone and clay products, and tobacco products, with declines from May, 1925, in the output of textiles, lumber, leather, and non-ferrous metals. The production of raw materials was greater in May than in either the previous month or a year ago, all major groups showing increases over both periods except forest products and minerals, which declined from a year ago.

After allowance for normal seasonal changes, the index of commodity stocks was higher at the end of May than at the end of either the previous month or a year ago, this condition being largely due to greater stocks of raw foodstuffs, as manufactured foodstuffs and raw materials declined.

The index of unfilled orders, covering principally building materials and iron and steel, was lower at the end of May than at the end of either the previous month or May, 1925, with each of the Major groups showing similar comparisons.

Irregular Price Movements

Only minor price changes have been noted in the market for chemicals during the month. Strength in copper and good demand for the sulphate have combined to strengthen values for the latter. Selling pressure has weakened some of the coal-tar chemicals and butyl alcohol has also sold off. There is no concerted price trend however and this applies to chemicals and oils and fats as well. The weighted index number for chemicals is now 113.66 as compared with 113.67 a month ago and 110.97 a year ago.

The weighted number for oils and fats declined from 169.79 in June to 164.71. A year ago the number stood at 153.07. Frequent changes in values for cottonseed oil have much to do with the movement of the weighted number.

Smaller Foreign Trade

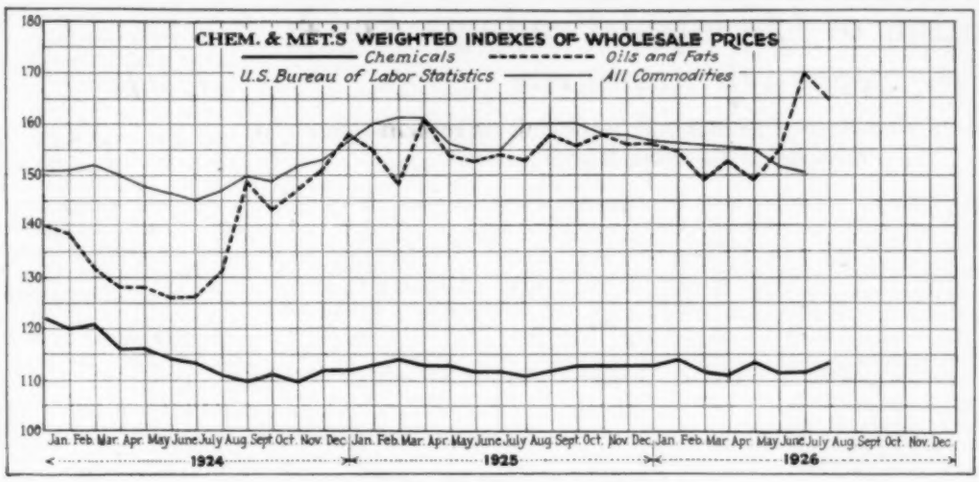
May showed a much larger falling off in imports of chemicals and allied products than in exports having dropped 14 per cent from $18,119,000 in May, 1925 to $15,628,000 in May, 1926, and 2 per cent in exports from $14,612,000 to $14,297,000, according to a report of the Bureau of Foreign and Domestic Commerce. There were no outstanding developments in the export trade but among the big fluctuations in imports most noticeable was the decrease in receipts of sodium nitrate.

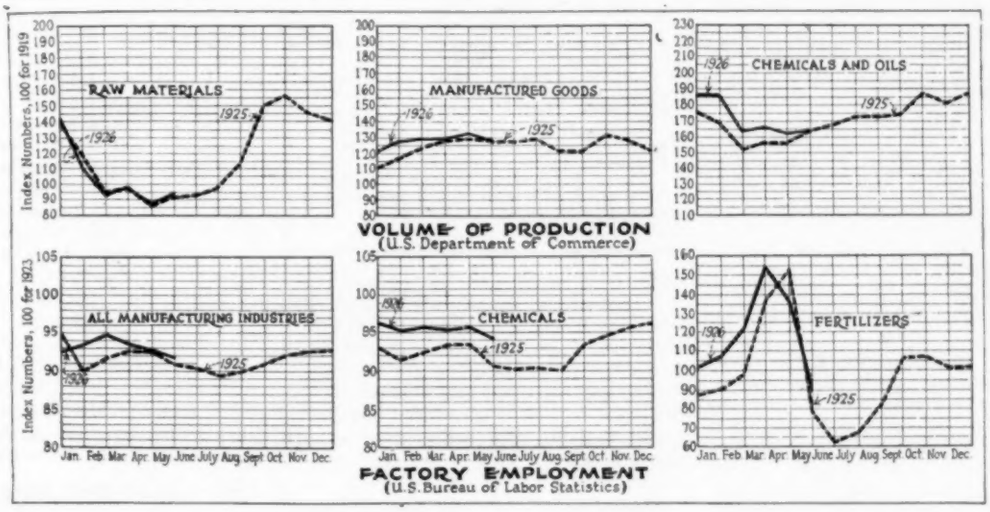
Once again the exports of Group 8, Chemicals and Related Products, aggregating $10,386,000 for the current month, 4 per cent more than May, 1925, were above the imports of $9,235,000, which were 23 per cent less than May, 1925.

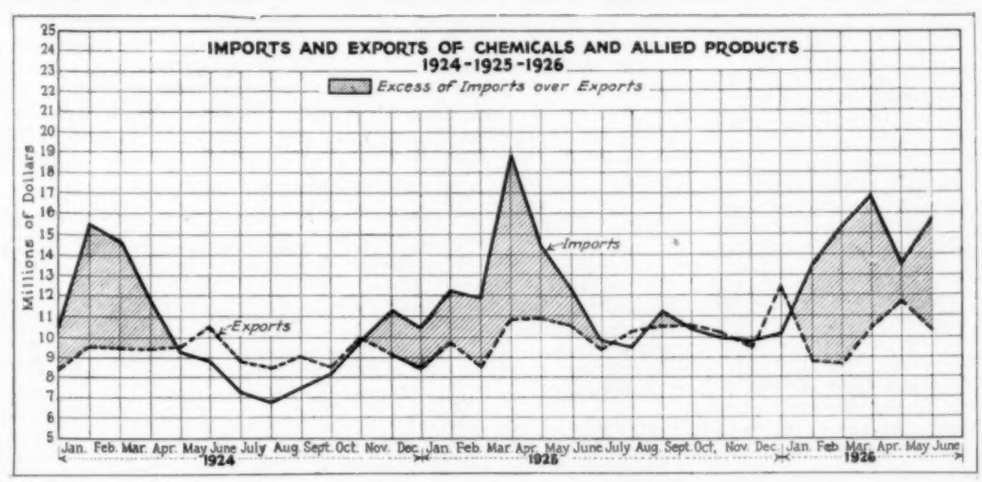
The fifty per cent drop in imports of fertilizers and materials was one of the outstanding features of the entire trade. This loss was due largely to the smallness in the incoming shipments of sodium nitrate as only 45 per cent as much came in the current month or a total of $2,845,000 (58,000 tons), a figure about one half the usual amount.

Chem. & Met.'s *Statistics of Business*

In The Chemical Engineering Industries







Market Conditions and Price Trends

Distribution of Chemical Products Above Seasonal Standards

Operations in Consuming Trades Are Reported to Have Gained Ground in the Past Month

PRODUCERS of heavy chemicals report that there has been an increased call for contract deliveries of these products and that shipments from producing points have been running to larger volumes than was the case in the preceding month. This statement is made after due allowance has been made for the smaller deliveries made to some consumers as a result of the customary closing of plants for inventory purposes. Such reports are in harmony with the state of general business as portrayed by different trade authorities and the conclusion is drawn that no decided slump has been met with in the chemical industry but rather that consumption has been holding above seasonal standards.

This does not mean that every branch of the industry is facing favorable conditions because there are instances where selling prices have been maintained at extremely low levels and competitive selling has made profits practically impossible. There are also cases where demand has proved of a disappointing nature as in the case of arsenic and calcium arsenate where large carryover stocks from the preceding season are yet to be worked off although asking prices represent losses to holders.

A feature of current trading has been found in the steady position of values for most of the important chemicals. This is shown by the fact that the weighted index number is practically the same as it was a month ago. Some of the lead pigments were lowered in price and aqua ammonia and butyl alcohol sold at lower levels. A few of the coal-tar intermediates also showed an easy tendency. Copper sulphate was strengthened by the action of the metal market and by the good consuming demand.

In the market for vegetable oils and fats attention centered on cottonseed oil because of the government report which indicated that another large cotton crop was in the making and consequently a large seed supply is promised for crushers. The scarcity of oil for prompt and nearby delivery, however, is preventing any return to very low prices. Glycerine also has been prominent because of its limited supply and the upward swing to values. Primary markets for China wood oil have advanced sharply and have affected domestic markets accordingly.

Tariff matters having a bearing on the markets, which came up for consideration during the month included a bearing on the case involving wood distillation chemicals the presentation of briefs on the petition for higher import duties on calcined magnesite, and applications, pro and con, for changes in the duty on materials made from synthetic phnelic resins.

Further progress was reported during the month in foreign markets in the way of trade agreements and the formation of syndicates. Prominent among these was the working agreement entered into by German producers of lacquers. Makers of prussiates in Germany also were welded into a syndicate with reports the latter had plans of international significance. The German Dye Trust also was credited with combining interests with calcium cyanide producers to manufacture leunaphos, a combined nitrogen and phosphoric and fertilizer which is produced electrolytically without the employment of sulphuric acid.

Leading Market Developments During the Month

Scarcity of stocks has created a strong situation in the market for all grades of glycerine.

Government cotton report indicates a large crop in prospect and values for cottonseed oil were lower.

Importers enter into case which alleges unfair competition from sellers of foreign synthetic phenolic resins.

Japan will investigate charges of dumping caustic soda and sulphate of ammonia in that country.

Large production of aqua ammonia causes selling pressure and prices have been quoted at lower levels.

Methanol Consumption Tops Production Totals

Production of refined methanol, as reported to the Department of Commerce by all of the methanol-refining plants in the United States, was 477,559 gal. in May as compared with 525,008 gal. in April and 417,727 gal. in May, 1925. The following table shows figures for the United States and Canada, and comprises the following grades of methanol: 95 per cent refined methanol, 97 per cent refined methanol, pure methanol, C. P. methanol and denaturing grade methanol.

METHANOL PRODUCTION AND CONSUMPTION

	Crude			Refined	
	Purchased[1], Gal.	Consumed, Gal.	Stocks (End of Month), Gal.	Produced, Gal.	Stocks (End of Month) Gal.
1926		United States			
January	503,973	731,466	656,565	596,997	637,300
February	516,820	691,730	685,995	483,059	636,699
March	583,085	756,346	750,480	559,505	557,711
April	531,370	633,731	850,999	525,008	623,538
May	604,598	802,337	876,428	477,559	567,444
Total (5 months)	2,739,846	3,615,610	.....	2,642,128	.....
1926		Canada			
January	.....	32,574	40,096	31,545	60,704
February	.....	39,570	29,478	38,070	69,371
March	.....	30,561	33,089	29,140	72,629
April	.....	28,072	22,451	26,995	75,276
May	.....	28,537	23,827	27,460	81,259
Total (5 months)	.....	159,314	.....	153,210	.....

[1] Does not include crude methanol produced by refinery.

Decline in Sales of German Potash Salts

With the announcement by the German Potash Syndicate of the April sales of German potash, it is possible to compare the 1925-1926 sales with those of previous years. For the fiscal year ended April 30, 1926, sales were 1,122,615 metric tons K_2O, about 2 per cent less than the previous year. Sales by months for the past three years are shown in the following table:

	1924–1925 Metric Tons	1925–1926 Metric Tons
May	22,043	73,074
June	27,654	81,447
July	47,298	95,603
August	102,491	104,447
September	127,171	101,196
October	78,710	73,538
November	74,066	57,605
December	84,818	58,921
January	166,546	94,866
February	201,868	185,510
March	143,959	139,118
April	66,773	57,290
	1,143,397	1,122,615

Although last year's sales were only slightly lower than those of the previous year, sales in the last four months of the fiscal year, which are the first four months of the calendar year, were 476,784 tons K_2O, whereas in the same period of 1925, they reached 579,146 tons.

The active position of the domestic fertilizer industry in the past year was favorable for a large use of potash salts and imports for the fiscal year as shown by latest available statistics were running ahead in volume of those for the corresponding period last year.

Flaxseed Report Shows Decline in Acreage and Yield

On July 10 the government issued its preliminary report on flaxseed. The report placed acreage at 2,843,000, condition as of July 1, 73 per cent, yield per acre 7 bu., and indicated total yield 19,886,000 bu. The preliminary report last year gave acreage as 3,466,000, condition 81.6 per cent, average yield 7.5 bu. and indicated total yield 26,100,000 bu. Hence the present re-

Market Conditions and Price Trends

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	**164.71**
Last month	169.79
July, 1925	153.07
July, 1924	136.25

Firmness in linseed and China wood oils was more than offset by the break in values for cottonseed oil and tallow. The weighted index number showed a marked decline with the rise and fall in prices for various oils and fats resulting from particular conditions rather than to any general price trend.

port is unfavorable in every respect as compared with that of a year ago. In the majority of years the final outturn of the crop has proved smaller than shown in the earlier estimates, and if this proves to be the case this year a relatively small crop will be harvested and a correspondingly larger amount of seed will have to be imported. Considered in itself the present report would have a bullish effect on prices for seed and oil but the large surplus of seed in the Argentine still has a bearish influence.

The following table shows the preliminary acreage and indicated yield for 1926, and the final estimates for the four preceding seasons:

	Acres	Bu.
1926	2,843,000	19,886,000
1925	3,012,000	22,007,000
1924	3,289,000	30,173,000
1923	2,014,000	17,060,000
1922	1,113,000	10,375,000

The final official estimate on the linseed crop of India has just been issued and shows the total area under linseed as 3,572,000 acres, which is 3 per cent below the area of last year. The total estimated yield is 401,000 tons, as against 501,000 tons last year, or a decrease of 20 per cent. The detailed figures for the provinces and states are:

INDIA LINSEED CROP

Province and States	Yield (1,000 Tons) 1925–26	Yield (1,000 Tons) 1924–25	Area (1,000 Acres) 1925–26	Area (1,000 Acres) 1924–25	Yield per Acre (Lbs.) 1925–26	Yield per Acre (Lbs.) 1924–25
Central Provinces and Berar (including Indian States)	80	107	1,232	1,180	145	203
United Provinces	186	205	1,082	1,105	348	416
Bihar and Orissa	103	123	687	731	336	377
Bengal	18	19	134	121	301	352
Bombay (including Indian States)	11	12	125	139	197	193
Punjab	3	3	29	31	232	217
Hyderabad	16	16	178	251	201	143
Kotah (Rajputana)	2	16	105	137	43	262
Total	401	501	3,572	3,695	251	304

In addition to the areas for which particulars are given above, linseed is grown in certain other tracts in India, and the average area so grown for the last five years amounts to about 223,000 acres, with an estimated yield of 25,000 tons.

Conditions in Foreign Trade Steady Sulphur Market

The higher prices which have ruled for sulphur in recent months have been due largely to domestic conditions. The closing of large mines, increased consumptive demand, the reduction of stocks above ground, and the lessening of competition among producers have been pointed out as the factors instrumental in appreciating values. However, the position of foreign markets, particularly the producing end, should not be disregarded in accounting for the strength of the American product. Sicilian mines have a potential capacity which would offer keen competition and as more than 50 per cent of our export trade is with European countries it is evident that the unfavorable position of the Sicilian trade removes it from the field of competition even if there were no agreements between American and Sicilian producers.

Sicilian production of sulphur in 1925 declined to 207,998 tons as compared with 223,577 tons in 1924. That the industry is not progressing is apparent from a report to the Department of Commerce which states that production and exportation of Sicilian sulphur during the first quarter of 1926 fell far below that for the same period of 1925. In 1926 production was 52,931 metric tons as compared with 93,688 tons in 1925. Exports totaled 60,288 tons while in 1925 they were 99,565. Recently at Catania the Sicilian sulphur refiners organized a federation called the Federazione Opifici Raffinerie Zolfi ed Affini.

At a recent meeting of members of the Sulphur Consortium results of business of 1925 and the anticipated business of 1926 were considered. In view of the present condition of the sulphur industry the managers were formally admonished to regulate production according to the demand. The assembly commended and approved what had been done hitherto in the way of loans put at the disposition of the sulphur industry through the Mineral Bank of the government and expressed hope and confidence that the national government would not disregard the just demands of the sulphur industry. It was pointed out, however, that in order to attract capital to the sulphur industry a reform in legislation was necessary in order that leases could be made for long periods and for equable rentals. It should be considered that the present unfavorable conditions causing a decrease in the production is due principally to the lack of industrial profits which does not permit the employment of competent laborers. The lack of profits is due to the heavy expenses and taxes levied on the industry and to the low selling prices. In fact, the Royal Commissioner of the Consorzio sold 65,000 tons annually at a very low price for future delivery as he predicted a hypothetic increase in the production which has not occurred. This action caused a decrease in the average selling prices of 75 lire per ton.

An agreement has recently been concluded between the Ente Autonomi per il Progresso dell' Industria Zolfifera and the Societa Generale Elettrica della Sicilia for the installation of electrical apparatus in various sulphur mines both for exploration and mining purposes. It is expected that such installations will be completed in about two years.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	**113.66**
Last month	113.67
July, 1925	110.97
July, 1924	110.61

There was very little change in the index number for chemicals during the month. Heavy chemicals are holding a steady price course and changes in values for miscellaneous selections had but little bearing on the weighted number. Copper sulphate was prominent because of its strength while butyl alcohol and coal-tar intermediates were of easy tenor.

Scarcity of Glycerine Stocks Strengthens Values

For many months a firm situation has existed in the market for glycerine. Consuming demand has placed a severe tax on productive capacities and larger purchases have been made in foreign markets in order to satisfy home requirements. In some quarters it had been expected that the strength of glycerine prices was but temporary but the market has continued to improve its position and top prices are now prevailing for all grades. It is evident that consumptive requirements have been enlarged but it is not so plain whether the increased call comes from new types of consumers or represents a corresponding increase in operations on the part of old consumers. The higher prices reached last month failed to bring on the market any appreciable resale lots which bears out reports that consumers are carrying no large surplus stocks.

Reports from abroad indicate that foreign markets have but little to offer for prompt or nearby shipment and inability to secure supplies abroad is having a tendency to cut down importations. Imports in May were 1,661,000 lb. and while this represents an increase of 80 per cent over receipts in May last year it was smaller than the total imported in any previous month of the current year.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to July 15.

Industrial Chemicals

		Current Price	Last Month	Last Year
Acetone, drums	lb.	$0.12 -$0.13	$0.12 -$0.13	$0.12 -$0.13
Acid, acetic, 28%, bbl.	cwt.	3.25 - 3.50	3.25 - 3.50	3.00 - 3.25
Boric, bbl.	lb.	.09 - .10	.08½- .10	.08 - .10
Citric, kegs	lb.	.44½- .45	.45 - .47	.45½- .47
Formic, bbl.	lb.	.10½- .11½	.10 - .11	.10½- .10¾
Gallic, tech., bbl.	lb.	.50 - .55	.45 - .50	.45½- .47
Hydrofluoric 30% carb.	lb.	.06 - .07	.06 - .07	.06½- .07
Lactic, 44%, tech., light, bbl.	lb.	.13½- .14	.13½- .14	.13 - .13½
22%, tech., light, bbl.	lb.	.06½- .07	.05½- .06	.06 - .06½
Muriatic, 18°, tanks	cwt.	.80 - .85	.80 - .85	.80 - .85
Nitric, 36°, carboys	cwt.	.05 - .05½	.05 - .05½	.04 - .04½
Oleum, tanks, wks.	ton	18.00 -20.00	18.00 -20.00	16.00- 17.00
Oxalic, crystals, bbl.	lb.	.10½- .11	.10½- .11	.10½- .11
Phosphoric, tech., c'bys.	lb.	.07 - .07½	.07 - .07½	.07½- .08
Sulphuric, 60°, tanks	ton	10.50 -11.00	9.50 -11.00	8.00 - 9.00
Tannic, tech., bbl.	lb.	.35 - .40	.35 - .40	.45 - .50
Tartaric, powd., bbl.	lb.	.29 - .30	.29 - .30	.29 - .30
Tungstic, bbl.	lb.	1.00 - 1.20	1.00 - 1.20	1.20 - 1.25
Alcohol, ethyl, 190 p'f. U.S.P. bbl.	gal.	4.90 - 5.00	4.90 - 5.00	4.90 -
Alcohol, Butyl, dr.	lb.	.18 - .18½	.18½- .19	.27 - .30
Denatured, 190 proof				
No. 1 special dr.	gal.	.29 - .40	.28 - .40	.50½-
No. 5, 188 proof, dr.	gal.	.29 - .32	.28 -	.50½-
Alum, ammonia, lump, bbl.	lb.	.03½- .04	.03½- .04	.03½- .04
Chrome, bbl.	lb.	.05½- .05½	.05½- .05½	.05½- .06
Potash, lump, bbl.	lb.	.02½- .03½	.02½- .03½	.02½- .03½
Aluminum sulphate, com., bags	cwt.	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Iron free, bg.	cwt.	2.00 - 2.10	2.00 - 2.10	2.40 - 2.45
Aqua ammonia, 26°, drums.	lb.	.03½- .04	.03½- .04	.06½- .06¾
Ammonia, anhydrous, cyl.	lb.	.13 - .15	.13 - .15	.28 - .30
Ammonium carbonate, powd. tech., casks	lb.	.07½- .08½	.08½- .10	.12½- .12¾
Sulphate, wks.	cwt.	2.55 -	2.55 -	2.55 -
Amylacetate tech., drums	gal.	1.75 - 1.85	1.80 - 2.00	2.75 - 3.00
Antimony Oxide, bbl.	lb.	.14 - .15	.14½- .15	.16 - .16½
Arsenic, white, powd., bbl.	lb.	.03½- .04½	.03½- .04½	.04½- .05
Red, powd., kegs	lb.	.11 - .11½	.11 - .11½	.13½- .14
Barium carbonate, bbl.	ton	48.00 -50.00	48.00 -50.00	51.00 -56.00
Chloride, bbl.	ton	63.00 -65.00	63.00 -65.00	66.00 -70.00
Nitrate, cask	lb.	.07¾- .08	.07¾- .08½	.07½- .08
Blanc fixe, dry, bbl.	lb.	.03¾- .04	.03¾- .04	.03¾- .04
Bleaching powder, f.o.b., wks., drums	cwt.	2.00 - 2.10	2.00 - 2.10	1.90 -
Borax, bbl.	lb.	.05 - .05½	.05 - .05½	.05 - .05½
Bromine, cs.	lb.	.45 - .47	.45 - .47	.47 - .48
Calcium acetate, bags	cwt.	3.25 - 3.50	3.25 - 3.50	2.75 - 2.80
Arsenate, dr.	lb.	.07½-	.07½-	.06 - .08
Carbide drums	lb.	.05½- .06	.05½- .06	.05 - .05½
Chloride, fused, dr., wks.	ton	21.00 -	21.00 -	21.00 -
Phosphate, bbl.	lb.	.07 - .07½	.07 - .07½	.06½- .07½
Carbon bisulphide, drums	lb.	.05½- .06	.05½- .06	.06 - .06½
Tetrachloride drums	lb.	.06½- .07	.06½- .06½	.07 - .07½
Chlorine, liquid, tanks, wks.	lb.	.04 - .04½	.04 - .04½	.04½-
Cylinders	lb.	.05½- .08	.05½- .08	.05½- .08
Cobalt oxide, cans	lb.	2.10 - 2.20	2.10 - 2.20	2.10 - 2.25
Copperas, bgs., f.o.b. wks.	ton	15.00 -18.00	15.00- 18.00	13.00 -14.00
Copper carbonate, bbl.	lb.	.16½- .17	.16½- .18	.16½- .17
Cyanide, tech., bbl.	lb.	.49 - .50	.49 - .50	.49 - .50
Sulphate, bbl.	cwt.	4.85 - 5.00	4.75 - 5.00	4.65 - 4.85
Cream of tartar, bbl.	lb.	.21 - .22	.21 - .22	.21 - .21½
Epsom salt, dom., tech., bbl.	cwt.	1.75 - 2.15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags	cwt.	1.30 - 1.40	1.30 - 1.40	1.35 - 1.40
Ethyl acetate, 85% drums	gal.	.80 - .82	.82 - .85	.87 - .90
99%, dr.	gal.	1.01 -	1.01 -	1.03 - 1.06
Formaldehyde, 40%, bbl.	lb.	.09 - .09½	.09 - .09½	.09 - .09½
Furfural, dr.	lb.	.15 - .17½	.17½-	.23 -
Fusel oil, crude, drums	gal.	1.35 - 1.40	1.40 - 1.50	2.70 - 3.00
Refined, dr.	gal.	2.50 - 3.00	2.50 - 3.00	4.00 - 4.50
Glaubers salt, bags	cwt.	1.15 - 1.25	1.15 - 1.25	1.20 - 1.40
Glycerine, c.p., drums, extra.	lb.	.30 - .32	.27 -	.19 - .19½
Lead:				
White, basic carbonate, dry, casks	lb.	.10½-	.10¾-	.10½-
White, basic sulphate, sck.	lb.	.09½-	.10 -	.10½-
Red, dry, sck.	lb.	.11½-	.12 -	.12½-
Lead acetate, white crys., bbl.	lb.	.14½- .15	.14½- .15	.15¼-
Lead arsenate, powd., bbl.	lb.	.14 - .15	.14 - .15	.13 - .14
Lime, chem., bulk	ton	8.50 -	8.50 -	8.50 -
Litharge, pwd., csk.	lb.	.11 -	.11½-	.12½-
Lithopone, bags	lb.	.05½- .06	.05½- .06	.06 - .06½
Magnesium carb., tech., bags.	lb.	.06½- .06¾	.06½- .06¾	.06¾- .07
Methanol, 95%, dr.	gal.	.55 - .58	.57 - .62	.65 - .68
97%, dr.	gal.	.57 - .62	.59 - .64	.67 - .69
Nickel salt, double, bbl.	lb.	.10 - .10½	.10 - .10½	.09 - .10
Single, bbl.	lb.	.10½- .11	.10½- .11	.10 - .11
Orange mineral, csk.	lb.	.13½-	.14 -	.16½-
Phosphorus, red, cases	lb.	.65 - .68	.68 - .70	.70 - .75
Yellow, cases	lb.	.32 - .33	.34 - .36	.37½- .40
Potassium bichromate, casks.	lb.	.08½- .08¾	.08½- .08¾	.08½- .08¾
Carbonate, 80-85%, calc., csk.	lb	.05½- .06	.06 -	.06 - .06½
Chlorate, powd.	lb.	.08½- .09	.08½- .09	.07½- .08
Cyanide, cs.	lb.	.55 - .57	.55 - .58	.47 - .62
First sorts, csk.	lb.	$0.09 -$0.09½	$0.08½-$0.09	$0.08½-$0.08½
Hydroxide(c'stic potash) dr.	lb.	.07½- .07¾	.07½- .07¾	.07½- .07½
Muriate, 80% bgs.	ton	34.90 -	34.90 -	34.55 -
Nitrate, bbl.	lb.	.06 - .06½	.06½- .06½	.06 - .07½
Permanganate, drums	lb.	.14½- .15	.14½- .15	.14½- .15
Prussiate, yellow, casks	lb.	.18½- .18½	.18½- .18½	.18½- .18¾
Sal ammoniac, white, casks	lb.	.05½- .06	.05½- .06½	.05½- .06
Salsoda, bbl.	cwt.	.95 - 1.00	1.10 - 1.20	1.20 - 1.40
Salt cake, bulk	ton	17.00 -18.00	17.00 -18.00	17.00 -19.00
Soda ash, light, 58%, bags, contract	cwt.	1.38 -	1.38 -	1.38 -
Dense, bags	cwt.	1.45 - 1.55	1.45 - 1.55	1.45 - 1.55
Soda, caustic, 76%, solid, drums, contract	cwt.	3.10 -	3.10 -	3.10 -
Acetate, works, bbl.	lb.	.04¼- .05	.04¼- .05	.05 - .05½
Bicarbonate, bbl.	cwt.	2.00 - 2.25	2.00 - 2.25	1.75 - 2.00
Bichromate, casks	lb.	.06½- .06½	.06½- .06½	.06½- .06½
Bisulphate, bulk	ton	5.00 - 5.50	5.00 - 5.50	6.00 - 7.00
Bisulphite, bbl.	lb.	.03½- .04	.03½- .04	.04½- .04½
Chlorate, kegs	lb.	.06½- .06½	.06¼- .06¼	.06½- .07
Chloride, tech.	ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom.	lb.	.18 - .22	.18 - .22	.19 - .22
Fluoride, bbl.	lb.	.08½- .09	.08½- .09	.09 - .09½
Hyposulphite, bbl.	lb.	2.50 - 3.00	2.65 - 3.00	.02½- .02½
Nitrate, bags	cwt.	2.50 -	2.57½-	2.55 -
Nitrite, casks	lb.	.08½- .09½	.08½- .09	.09 - .09½
Phosphate, dibasic, bbl.	lb.	.03½- .03½	.03½- .03½	.03½- .03½
Prussiate, yel. drums	lb.	.10½- .10½	.10 - .10½	.10½- .10½
Silicate (30°, drums)	cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%, dr.	lb.	.03 - .03½	.03 - .03½	.02½- .03
Sulphite, crys., bbl.	lb.	.03 - .03¼	.02½- .03	.02¼- .03
Strontium nitrate, bbl.	lb.	.08½- .09	.09 - .10	.09½- .10
Sulphur, crude at mine, bulk.	ton	19.00 -	19.00 -	14.00 -16.00
Chloride, dr.	lb.	.05 - .05½	.05 - .05½	.04½- .05
Dioxide, cyl.	lb.	.09 - .10	.09 - .10	.08½- .09
Flour, bag	cwt.	2.70 - 3.00	2.70 - 3.00	2.25 - 2.35
Tin bichloride, bbl.	lb.	.17 -	.17 -	.15½-
Oxide, bbl.	lb.	.64 -	.64 -	.58 -
Crystals, bbl.	lb.	.41½-	.41½-	.38½-
Zinc chloride, gran., bbl.	lb.	.07 - .07½	.07 - .08	.06 - .07½
Carbonate, bbl.	lb.	.11 - .11½	.10½- .11	.12 - .14
Cyanide, dr.	lb.	.40 - .41	.40 - .41	.40 - .41
Dust, bbl.	lb.	.09 - .10	.09 - .10	.08 - .08½
Zinc oxide, lead free, bag.	lb.	.07½-	.07¾-	.07¾-
5% lead sulphate, bags.	lb.	.07 -	.07 -	.06½-
Sulphate, bbl.	cwt.	2.75 - 3.00	3.00 - 3.50	3.50 - 3.75

Oils and Fats

		Current Price	Last Month	Last Year
Castor oil, No. 3, bbl.	lb.	$0.12 -$0.13	$0.12½-$0.13	$0.16½-$0.16½
Chinawood oil, bbl.	lb.	.15 -	.12 - .12½	.12½- .13
Coconut oil, Ceylon, tanks, N. Y.	lb.	.10½-	.10½-	.09½-
Corn oil crude, tanks, (f.o.b. mill)	lb.	.12½-	.13 -	.09½-
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.12½-	.14 -	.09¾-
Linseed oil, raw, car lots, bbl.	lb.	11.4 -	11.3 -	14.1 -
Palm, Lagos, casks	lb.	.08½- .09	.08½- .9½	.09½- .09½
Niger, casks	lb.	.08½-	.08½-	.08½-
Palm Kernel, bbl.	lb.	.10½-	.10 - .10½	.09½-
Peanut oil, crude, tanks(mill)	lb.	.13 -	.12½-	.10½-
Perilla, bbl.	lb.	-	.15 - .15½	.14½-
Rapeseed oil, refined, bbl.	gal.	.89 - .90	.90 - .92	.98 - .99
Sesame, bbl.	lb.	-	-	.15 - .15½
Soya bean tank (f.o.b. Coast)	lb.	.10½-	.10½-	.10½-
Sulphur(olive foots), bbl.	lb.	.08½-	.08¼-	.09½-
Cod, Newfoundland, bbl.	gal.	.62 - .65	.60 - .65	.62 - .63
Menhaden, light pressed, bbl.	gal.	.65 - .67	.65 - .67	.72 - .75
Crude, tanks(f.o.b. factory)	gal.	.47½- .50	.55 -	.55 - .58
Whale, crude, tanks	lb.	-	-	-
Grease, yellow, loose	lb.	.08½-	.08½-	.08½- .09
Oleo stearine	lb.	.14½-	.14 -	.11 - .11½
Red oil, distilled, d.p. bbl.	lb.	.10 - .10½	.11½- .11½	.11½- .11½
Tallow, extra, loose	lb.	.08¼-	.09 -	.08¼-

Coal-Tar Products

		Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl.	lb.	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl.	lb.	.85 - .90	.90 - .95	.75 - .80
Alpha-naphthylamine, bbl.	lb.	.35 - .36	.35 - .36	.35 - .36
Aniline oil, drums, extra.	lb.	.15 - .16	.16 - .16½	.16 - .16½
Aniline salts, bbl.	lb.	.22 - .24	.20 - .22	.20 - .22
Anthracene, 80%, drums	lb.	.60 - .65	.60 - .65	.65 - .70
Benzaldehyde, U.S.P., dr.	lb.	1.15 - 1.25	1.30 - 1.35	1.50 -
Benzidine base, bbl.	lb.	.72 - .74	.72 - .75	.78 - .80
Benzoic acid, U.S.P., kgs.	lb.	.58 - .60	.56 - .60	.75 - .85
Benzyl chloride, tech, dr.	lb.	.25 - .26	.25 - .26	.35 - .36
Benzol, 90%, tanks, works.	gal.	.25 - .28	.25 - .28	.23 - .24
Beta-naphthol, tech., drums	lb.	.22 - .24	.22 - .24	.24 - .25
Cresol, U.S.P., dr.	lb.	.18 - .20	.18 - .20	.23 - .25
Cresylic acid, 97%, dr., wks.	gal.	.59 - .65	.63 - .71	.59 - .62
Diethylaniline, dr.	lb.	.58 - .60	.58 - .60	.59 - .61
Dinitrophenol, bbl.	lb.	.31 - .35	.30 - .33	.35 - .38
Dinitrotoluen, bbl.	lb.	.17 - .18	.16 - .17	.18 - .20
Dip oil, 25% dr.	gal.	.28 - .30	.28 - .30	.26 - .28
Diphenylamine, bbl.	lb.	.45 - .47	.48 - .50	.48 - .50
H-acid, bbl.	lb.	.63 - .65	.68 - .72	.70 - .74

Coal-Tar Products—Continued

		Current Price	Last Month	Last Year
Naphthalene, flake, bbl.	lb.	$0.05½-$0.06	$0.05½-$0.06	$0.05 -$0.05½
Nitrobenzene, dr.	lb.	.09 - .10	.09½- .10	.09 - .10
Para-nitraniline, bbl.	lb.	.45 - .48	.50 - .53	.65 - .67
Para-nitrotoluine, bbl.	lb.	.28 - .32	.30 - .35	.40 - .42
Phenol, U.S.P., drums	lb.	.22 - .24	.22 - .24	.23 - .25
Picric acid, bbl.	lb.	.30 - .40	.30 - .40	.20 - .22
Pyridine, dr.	lb.	4.10 -.....	4.50 -.....	4.10 - 4.20
R-salt, bbl.	lb.	.47 - .50	.40 - .44	.50 - .55
Resorcinal, tech, kegs.	lb.	1.30 - 1.35	1.35 - 1.40	1.30 - 1.40
Salicylic acid, tech., bbl.	lb.	.30 - .32	.33 - .34	.32 - .33
Solvent naphtha, w.w.,tanks	gal.	.35 -.....	.35 -.....	.24 - .25
Tolidine, bbl.	lb.	.90 - .95	.95 - .96	1.00- 1.05
Toluene, tanks, works	gal.	.35 -.....	.35 -.....	.26 -.....
Xylene, com., tanks	gal	36 - .41	.36 - .41	.24 - .26

Miscellaneous

		Current Price	Last Month	Last Year
Barytes, grd., white, bbl.	ton	$23.00-$25.00	$17.00-$17.50	$17.00-$17.50
Casein, tech., bbl.	lb.	.17½- .20	.16½- .18½	.13 - .14
China clay, powd., f.o.b. Va.	ton	10.00 -20.00	10.00 -20.00	12.00 -15.00
Imported, powd.	ton	45.00 -50.00	45.00 -50.00	45.00 -50.00
Dry colors:				
Carbon gas, black (wks.)	lb.	.08 - .08½	.08 - .08½	.06½- .08
Prussian blue, bbl.	lb.	.32 - .33	.32 - .34	.35 - .37
Ultramine blue, bbl.	lb.	.08 - .35	.08 - .35	.08 - .35
Chrome green, bbl.	lb.	.28 - .30	.28 - .30	.27 - .29
Carmine red, tins	lb.	5.00 - 5.10	5.00 - 5.10	4.25 - 4.50
Para toner	lb.	.80 - .90	.90 - .95	.95 - 1.00
Vermilion, English, bbl.	lb.	1.45 - 1.50	1.40 - 1.45	1.40 - 1.45
Chrome yellow, C. P., bbl.	lb.	.17 - .18	.17½- .18	.18½- .19
Feldspar, No. 1 (f.o.b. N. C.)	ton	6.00 - 6.50	6.00 - 6.50	6.50 - 7.00
Graphite, Ceylon, lump, bbl	lb.	.07 - .09½	.08½- .09	.07 - .07½
Gum copal, Congo, bags.	lb.	.09½- .10	.09½- .10	.08 - .10
Manila, bags	lb.	.15 - .18	.14 - .16	.14 - .16
Damar, Batavia, cases	lb.	.25 - .25½	.25 - .26	.28½- .28½
Kauri, No. 1 cases	lb.	.55 - .57	.57 - .65	.58 - .62
Kieselguhr (f.o.b. N. Y.)	ton	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc.	ton	38.00 -40.00	35.00 -42.00	35.00 -40.00
Pumice stone, lump, bbl.	lb.	.05 - .07	.04½- .08	.05 - .05½
Imported, casks	lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, H.	bbl.	14.15 -.....	13.00 -.....	8.40 - 8.50
Turpentine	gal.	.86 -.....	.85 -.....	.94 -.....
Shellac, orange, fine, bags	lb.	.29 - .30	.29 - .30	.62 - .65
Bleached, bonedry, bags	lb.	.36 - .40	.33 - .35	.67 - .69
T. N. bags	lb.	.27 - .28	.26 - .27	.58 - .59
Soapstone (f.o.b. Vt.), bags	ton	10.00 -12.00	9.50 -10.00	7.50 - 8.00
Talc, 200 mesh (f.o.b. Vt.)	ton	11.00 -.....	11.00 -.....	10.50 -.....
200 mesh (f.o.b. Ga.)	ton	7.50 -10.00	7.50 -10.00	8.00 -12.00
325 mesh (f.o.b. N. Y.)	ton	14.75 -.....	14.75 -.....	14.75 -.....
Wax, Bayberry, bbl.	lb.	.21 - .22	.20 - .22	.21 - .21½
Beeswax, ref., light	lb.	.47 - .48	.46 - .47	.38 - .39
Candelilla, bags	lb.	.34 - .35	.36 - .37	.32 - .33
Carnauba, No. 1, bags	lb.	.50 - .51	.48 - .49	.37 - .38
Paraffine, crude 105-110 m.p.	lb.	.05½- .06	.06 - .06½	.06½-.....

Ferro-Alloys

		Current Price	Last Month	Last Year
Ferrotitanium, 15-18%	ton	$200.00-.....	$200.00-.....	$200.00-.....
Ferrochromium, 1-2%	lb.	.23- .25	.23- .35	.24-.....
Ferromanganese, 78-82%	ton	88.00-90.00	88.00-90.00	115.00-.....
Spiegeleisen, 19-21%	ton	33.00-34.00	33.00-34.00	32.00-.....
Ferrosilicon, 10-12%	ton	33.00-38.00	33.00-38.00	39.50-43.00
Ferrotungsten, 70-80%	lb.	1.00- 1.05	1.10- 1.15	.90- ...
Ferro-uranium, 35-50%	lb.	4.50-.....	4.50-.....	4.50-.....
Ferrovanadium, 30-40%	lb.	3.25- 4.00	3.25- 4.00	3.25- 3.75

Non-Ferrous Metals

		Current Price	Last Month	Last Year
Copper, electrolytic	lb.	$0.14 -.....	$0.13½-.....	$0.14½-$0.15¼
Aluminum, 96-99%	lb.	.27 - .28	.27 - .28	.27 - .28
Antimony, Chin. and Jap.	lb.	.13½- .13¾	.19½- .23	.20½-.....
Nickel, 99%	lb.	.35 -.....	.34 -	.31 - .32
Monel metal, blocks	lb.	.32 - .33	.32 - .33	.32 - .33
Tin, 5-ton lots, Straits	lb.	.62¾-.....	.59¼-.....	.57½-.....
Lead, New York, spot	lb.	8.25 -.....	8.20 -.....	.09?-.....
Zinc, New York, spot	lb.	7.60 -.....	.08¾-.....	.07½-.....
Silver, commercial	oz.	.63¾-.....	.67 -.....	.63¼-.....
Cadmium	lb.	.60 -.....	.60 -.....	.60 -.....
Bismuth, 500-lb. lots	lb.	2.70 - 2.75	2.65 - 2.70	1.30 - 1.35
Cobalt	lb.	2.50 -.....	2.50 -.....	2.50 - 3.00
Magnesium, ingots, 99%	lb.	.75 - .80	1.00 -.....	.90 - .95
Platinum, ref	oz.	114.00-.....	112.00-.....	117.00-.....
Palladium, ref.	oz.	70.00- 72.00	87.50- 88.00	78.00-.....
Mercury, flask.....75 lb.		91.25-.....	91.00-.....	79.00-80.00
Tungsten powder	lb.	1.18- 1.20	1.20-.....	.95- 1.00

Ores and Semi-finished Products

		Current Price	Last Month	Last Year
Bauxite, crushed, wks.	ton	$5.50- $8.50	$5.50- $8.50	$5.50- $8.75
Chrome ore, c.f. post	ton	21.00- 24.00	21.00- 24.00	18.50- 24.00
Coke, fdry., f.o.b. ovens	ton	3.75- 4.25	3.75- 4.25	4.75- 5.00
Fluorspar, gravel, f.o.b. Ill.	ton	18.00-.....	18.00-.....	17.50- 18.50
Ilmenite, 52% TiO_2, Va.	lb.	.01½-.....	.01½-.....	.01½-.....
Manganese ore, 50% Mn., c.i.f. Atlantic Ports	unit	.40 - .42	.40 - .42	.42 - .43
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y.	lb.	.55 - .70	.55 - .70	.60- .70
Monazite, 6% of ThO_2	ton	120.00-.....	120.00-.....	120.00-.....
Pyrites, Span. fines, c.i.f.	unit	.13½-.....	.13½-.....	.11½- .12
Rutile, 94-96% TiO_2	lb.	.12 - .15	.12 - .15	.12 - .15
Tungsten, scheelite, 60% WO_3 and over	unit	12.50 -13.00	12.50 -13.00	9.50 - 9.75
Vanadium ore, per lb. V_2O_5	lb.	.30 - .35	.30 - .35	1.00 - 1.25
Zircon, 99%	lb.	.03 -.....	.03 -.....	.06 - .07

Current Industrial Developments

New Construction and Machinery Requirements

New England

Me., Great Works — Penobscot Chemical Fibre Co., awarded contract for the reconstruction of a 1 story, 60 x 185 ft. soda pulp mill drying room to Morton C. Tuttle Co., 862 Park Sq. Bldg., Boston, Mass. Estimated cost $40,000.

Mass., Brookfield — McLaurin-Jones Co., manufacturers of gummed paper, awarded contract for the construction of a 2 story, 65 x 86 ft. factory to Central Bldg. Co., 58 Front St., Worcester. Estimated cost $50,000.

Mass., Forest Hills (mail Boston)—Harvard University, c/o Stevens & Lee, 45 Newbury St., Boston, Archt., is having plans prepared for the construction of a 2 story anti-toxin laboratory addition here. Estimated cost $150,000.

Mass., Springfield—Kibbe Candy Co., 37 Harrison Ave., plans the construction of a candy factory on Berkshire Ave. Estimated cost $50,000. Architect not selected.

Middle Atlantic

N. J., Gloucester—Hinde & Dauch Paper Co., 401 West Water St., Sandusky, O., awarded contract for the construction of 2 story, 60 x 150 ft. and 100 x 160 ft. factory buildings here to Otto Randolph, Inc., 53 West Jackson Blvd., Chicago, Ill.

N. J., Hoboken—Cooper Hewitt Electric Co., W. A. D. Evans, Pres., 9 River St., is having plans prepared for the construction of a 6 story, 100 x 430 ft. plant, including glassware manufacturing and shipping departments, laboratories, etc., at Eighth and Adams Sts. Lockwood, Greene & Co., Pershing Sq., New York, N. Y., are engineers.

N. Y., New York—United States Gypsum Co., 205 West Monroe St., Chicago, Ill., will build a 1 story, 56 x 240 ft. plant at 135th St. and East River here, by day labor. Private plans.

Pa., Bridgeville—James S. Sipe & Co., paint manufacturers, awarded contract for the construction of a 2 story, 60 x 160 ft. plant, to The Austin Co., Union Trust Bldg., Pittsburgh. Estimated cost $50,000.

Pa., Bath — Keystone Portland Cement Co., c/o E. J. Fox, Easton Trust Co. Bldg., Easton, has acquired a site near here and plans the construction of a mill. Estimated cost $350,000.

Pa., Clairton—Carnegie Steel Co., Carnegie Bldg., Pittsburgh, awarded contract for the construction of 366 additional by-product coke ovens here to Koppers Co., Union Trust Bldg., Pittsburgh. Estimated cost $16,000,000.

Pa., Philadelphia — Bornat Inc., c/o Frazer Co., 1600 Walnut St., Engr., will soon award contract for the construction of a 2 story, 213 x 218 ft. dyeing and cleaning plant. Estimated cost $400,000. S. G. Matthews, 2016 West Lippincott St., is architect.

Pa., Philadelphia—Crescent Ink & Color Co., 460 North 5th St., plans the construction of a 1 story, 30 x 52 ft. addition to factory at 5th and Hamilton Sts. P. S. Tyre, 114 South 15th St., is architect.

South

Ala., North Birmingham (Birmingham P. O.)—Alabama Portland Cement Co., J. W. Johnson, V. Pres. and Gen. Mgr., Birmingham, recently acquired the plant of the Phoenix Portland Cement Co., and plans to expend $250,000 for extensions here.

Ga., Cedartown—Goodyear Tire & Rubber Co., East Market St., Akron, O., will soon award contract for the construction of a 2 story, 150 x 500 and 150 x 150 ft. factory and a 60 x 100 ft. warehouse here. Lockwood, Greene & Co., 24 Federal St., Boston, Mass., are architects.

Ga., Fort Benning—Constructing Quartermaster, War Dept., Washington, D. C., awarded contract for the construction of a laboratory here, to Algernon Blair, Montgomery, Ala., cost $26,475.

La., Lake Charles—Massasoit Mfg. Co., 134 Pocasset St., Fall River, Mass., awarded contract for the construction of first unit to cellulose plant here, 1 story, 30 x 32 ft. to P. O. Olivier & Son, Inc., Lake Charles, La. Three other units including chemical plant will be built later. Estimated cost $200,000.

La., Minden—Shreveport Mineral Corp., J. J. Kean, plans the construction of a salt mill near here. Estimated cost $500,000.

Miss., Natchez—Caddo-DeSoto Oil Mills Co., M. C. Stockbridge, Shreveport, La., is having preliminary plans prepared for the construction of a cotton oil mill. Estimated cost $250,000. Private plans.

Tenn., Johnson City—Johnson City Shale Brick Co., plans to rebuild plant recently destroyed by fire. Loss is estimated at $200,000.

Tenn., Lewisburg—Borden's Milk Co., 110 Hudson St., New York, N. Y., plans the construction of a milk condensing plant here. Estimated cost $300,000.

Tenn., Memphis—Wm. A. Webster Laboratories, 224 East St., plans the construction of a 1 story addition to laboratory. Estimated cost $150,000. E. L. Harrison, Union & Pacific Bank Bldg., is architect.

Middle West

Ill., Abingdon—Abingdon Sanitary Mfg. Co., manufacturers of plumbing supplies, awarded contract for the construction of six 1 story, 50 x 600 and 100 x 600 ft. factory buildings to Boher, Dunlevy Construction Co. Estimated cost $650,000.

Ill., Chicago — Bd. of Education, J. E. Byrnes, Bus. Mgr., will receive bids until July 15 for laboratory equipment for Morgan Park high school.

Ind., Greenfield—Ely Lilly & Co., J. K. Lilly, 210 East McCarthy St., is having plans prepared for the construction of a 1 story addition to biological laboratory. Estimated cost $25,000. Baggett & Hibben, Continental Bank Bldg., Indianapolis, are architects.

Ind., Indianapolis—Citizens Gas Co., 47 South Pennsylvania St., manufacturers of sulphate of ammonia, plans the construction of a storage building. Estimated cost $65,000. Private plans.

Ind., Indianapolis—Hide Leather & Belting Co., 225 South Meridian St., is having plans prepared for the construction of a 4 story factory. Estimated cost $75,000. F. S. Cannon, 21 Va Ave., is architect.

Ind., Indianapolis—Indianapolis Tire & Battery Co., 710 North Meridian St., is receiving bids for the construction of a factory. S. Craig & Co., 31 West Ohio St., are architects.

Ind., Indianapolis — Standard Nut Margarine Co., Roosevelt and Lewis Sts., is receiving bids for the construction of a 2 story, 50 x 80 ft. factory. Estimated cost $50,000. R. N. Edwards Co., 120 East Market St. No. 45, is architect.

Ind., Michigan City — Cabranette Co., J. L. Weiner, 38 North Michigan Ave., Chicago, manufacturers of porcelain steel kitchen equipment, awarded contract for the construction of a 1 story, 90 x 500 ft. factory to P. H. Lorenz, Moline, Ill.

Mich., East Lansing—State Bd. of Agriculture, H. H. Halladay, Secy., awarded contract for the construction of a 3 story chemistry building for Michigan State College to F. Triel, Saginaw. Estimated cost $300,000. Owners will purchase equipment.

Mich., River Rouge (Detroit P. O.)—United States Gypsum Co., 205 West Monroe St., Chicago, Ill., will build a gypsum calcining plant here, by day labor. Private plans.

O., Cleveland—City, D. S. Blossom, Dir. of Public Welfare, City Hall, awarded contract for the construction of a 2 story, 51 x 170 ft. diagnostic laboratory on Scranton Rd. to de Hamel Construction Co., Plymouth Bldg. $125,000. Contract for equipment awarded.

O., Cleveland—Ferbert Schondorfer Co., A. J. Ferbert, Pres., Elmwood Ave., manufacturers of paints and varnishes, awarded contract for the construction of a 4 story, 60 x 90 ft. addition to factory, to The Austin Co., 16112 Euclid Ave. Estimated cost $75,000.

O., Cleveland—The State Chemical Mfg. Co., J. H. Zucker, Pres., 2160 East 2nd St., manufacturers of janitor and laundry supplies, awarded contract for the construction of a 2 story, 55 x 140 ft. factory on Superior Ave., to Dresser Co., The Arcade. Estimated cost $50,000.

O., Cleveland—W. S. Tyler Co., C. Zimmerman, Treas., 3615 Superior Ave., manufacturers of ornamental iron and bronze, awarded contract for the construction of a 1 story, 43 x 50 ft. addition to annealing plant at 1370 East 30th St. to Sam W. Emerson Co., 1836 Euclid Ave. Estimated cost $40,000.

O., Cleveland—The Willard Storage Battery Co., c/o P. H. Voth, Const. Mgr., East 131 St., awarded contract for the construction of a 3 story, 64 x 131 ft. acid storage building to H. K. Ferguson Co., 4900 Euclid Ave. Estimated cost $150,000.

O., Columbiana — Standard Porcelain Works, will soon receive bids for the construction of a 2 story factory. Estimated cost $45,000.

O., Dayton—United States Army, E. R. George, Const. Quartermaster, Wright Field, awarded contracts for the construction of a 1 story, 300 x 480 ft. laboratory to Danis Hunt Construction Co., First and Webb Sts., and a 3 story, 53 x 250 ft. administration building to E. H. Latham & Co., 60 East Broad St., Columbus. Estimated cost $298,300 and $206,825 respectively.

O., Fairport Harbor—P. C. Tomson Co., 27 Washington Ave., lye manufacturers, will soon award contract for the construction of a 2 story, 121 x 221 ft. plant. Ballinger Co., 12th and Chestnut Sts. Philadelphia, Pa., is architect.

O., Gibsonburg — Gibsonburg Lime & Products Co., F. W. Zorn, plans the construction of a plant. Estimated cost $200,000. Engineer not selected.

Wis., Marinette—Northern Paper Mills, Day St., Green Bay, awarded contract for the construction of two hydro-electric dams at Chalk Hill and White Rapids on the Menominee River near here, to Siems, Helmers & Schaffner, 514 Guardian Life Bldg., St. Paul, Minn.

Wis., Milwaukee—Pittsburgh Plate Glass Co., 205 Lake St., is having plans prepared for the construction of two 3 story factory buildings for manufacture of paint. Kirchhoff & Rose, 210 Sycamore St., are architects. Special paint machinery will be required.

West of Mississippi

Ark., Hot Springs—Coca Cola Bottling Co., Van M. Lyell, awarded contract for the construction of a 2 story, 50 x 120 ft. bottling plant on Market St. to G. H. Burden, Moore & Turner Bldg., Little Rock. Estimated cost $75,000.

Ark., Walnut Ridge — Campbell Heinz Co., Federal Bank Bldg., Memphis, Tenn., plans the construction of a zinc concentrating plant here.

Colo., Johnstown — H. Havemeyer, 106 Wall St., New York, N. Y., plans the construction of a molasses factory near here. Estimated cost $1,000,000.

Ia., Dubuque—Rainbow Oil Co., L. Dax, Mgr., awarded contract for the construction of a 2 story, 40 x 100 ft. plant to A. Zwack, 1301 Central Ave. Estimated cost $40,000.

Mo., Mexico—A. P. Green Fire Brick Co., A. P. Green, Pres., plans the construction of a 1 story, 60 x 500 ft. plant. Estimated cost $250,000. Private plans.

Okla., Grandfield—Bell Oil Co., had preliminary plans prepared for the construction of a new 6 battery cracking plant for oil refinery. Estimated cost $500,000. T. O. Runyan, is engineer.

Okla., Pryer—Farmers Co-Operative Gin Co., is receiving bids for the construction of a cotton compress, 50 bales cotton and 25 ton cottonseed daily capacity. Estimated cost $50,000. Private plans. Equipment to cost $18,000 will be required.

Okla., San Springs—C. R. Miller Cotton Factory, awarded contract for the construction of a 1 and 2 story, 83 x 370 ft. addition to factory for bleaching plant, to Grimshaw Construction Co., Kennedy Bldg., Tulsa. $296,000.

Okla., Southard—United States Gypsum Co., 205 West Monroe St., Chicago, Ill., will build an addition to plant here, by day labor. Private plans.

Okla., Tulsa—Ozark Chemical Co., P. Keeley, Mgr., will build an addition to sulphuric acid plant to increase the capacity to 25 ton of 66 deg. acid per day. Estimated cost $400,000. Private plans.

Okla., Vinita—Aikin Bros. Canning Co., is the market for pulp machinery for proposed canning plant.

Texas—Delaware Punch Co., c/o H. K. Lyons, Granado and N. San Marcos Sts., San Antonio, is having preliminary plans prepared for the construction of bottling plants at Corpus Christi, Alice and Mercedes. Estimated cost $100,000, $25,000 and $25,000 respectively; also plans about 18 plants in various cities throughout the state, cost ranging from $25,000 to $150,000 each. Private plans. New machinery will be required.

Tex., Blue Ridge—Texas Salt Mine Co., is having preliminary plans prepared for the development of salt deposits, 150 ton rock salt daily output. Estimated cost $500,000. The Foundation Co., 120 Liberty St., New York, is engineer and will purchase all equipment.

Tex., Dalray—Texas Oil Co., plans the construction of a distribution plant, etc. Estimated cost $200,000. Private plans. Work will probably be done by day labor. Equipment will be required.

Tex., Donna—Val Verde Mercantile Corp., H. P. Hansen, Pres., is having preliminary plans prepared for the construction of a canning and refrigeration plant. Estimated cost $500,000. Private plans.

Tex., Galveston—Galveston Fig & Preserving Co., c/o J. Sterling, awarded contract for the construction of a 1 story, 60 x 256 ft. fig preserving and canning plant to J. T. Dyess, Texas City. Estimated cost $40,000. Owner will be in the market for machinery later.

Tex., Los Angeles—Siganal Gasoline Co., Inc., Bartlett Bldg., is having plans prepared for the construction of a 15,000 gal. casinghead gasoline plant in Reagan County. Estimated cost $350,000. Private plans. New equipment will be required.

Tex., Ranger—Petroleum Products Corp., Independence, Kan., has acquired a refinery here, and plans extensions and improvements for the manufacture of mineral rubber, also the installation of a cracking plant for crude oil. Estimated cost $250,000. Private plans. New machinery will be required.

Tex., Shafter—Presidio Mining Co., is having plans prepared for the construction of a 300 ton cyanide mill including dissolving plant, etc., for treatment of silver ore. Estimated cost $200,000. Private plans. Machinery will be required.

Tex., Three Rivers—Three Rivers Glass Co., plans the construction of a 35 ton glass furnace, 60,000 bottles daily capacity. Estimated cost $35,000. Private plans.

For West

Calif., Fresno—L. H. Davis & Co., San Benito and H Sts., plans the construction of a 1 story, 60 x 228 ft. date and fig packing plant. Equipment to cost $20,000 will be required.

Calif., Hilmar—Mayenberg Milk Co., 1 Drumm St., San Francisco, has acquired a site and plans the construction of a milk condensary here. Estimated cost $40,000.

Calif., Long Beach—City plans the construction of a gas plant, 5,000,000 cu.ft. daily capacity. Estimated cost $150,000. Private plans.

Calif., Marysville — Northern California Canning Peach Growers' Assn., is having preliminary plans prepared for the construction of a canning plant. Estimated cost $150,000. J. M. Cremin, 800 G St., is interested.

Calif., Oleum—Union Oil Co., Mills Bldg., San Francisco, awarded contract for the construction of a 2 story laboratory to Lawton & Vesey, 354 Hobart St., Oakland. $40,000.

Calif., Richmond — Standard Sanitary Mfg. Co., 1000 Brannan St., San Francisco, manufacturers of plumbing goods, is receiving bids for the construction of a 2 story, 135 x 250 ft. warehouse here. Estimated cost $175,000. J. J. Donovan, Tapscott Bldg., Oakland, is architect.

Calif., San Francisco—Royal Tallow & Soap Co., 1260 Davidson Ave., awarded contract for the construction of a 1 story factory at Davidson and Newhall Aves. to S. Rasori, 270 Tehama St. $40,000.

Calif., San Francisco — State Normal School, is having plans prepared for the construction of a 2 story laboratory building on Waller St. Estimated cost $160,000. B. G. McDougall, Forum Bldg., Sacramento, is architect.

Calif., San Pablo — Standard Sanitary Mfg. Co., 10th and Brannan St., San Francisco, manufacturers of plumbing fixtures, awarded contract for the construction of a 350 x 1250 ft. plant here, to P. J. Walker Co., Sharon Bldg., San Francisco. $500,000.

Canada

Ont., Bridgeburg—Bd. of Education, plans the construction of a high school including physics and chemistry laboratories, etc. Estimated cost $175,000. A. Collins, c/o owner, is architect. Equipment will be required.

Ont., London—Canadian Kellogg Corn Flakes Co., F. Gordon, Mgr., manufacturers of cereals, plans extension to factory. Estimated cost $150,000. Watt & Blackwell, Bank of Toronto Bldg., are engineers. New equipment will be required.

Ont., Port Arthur—Thunder Bay Pulp & Paper Co., will build a paper mill by day labor. Estimated cost $500,000. Work will be done under the supervision of E. Cutell, Engr., c/o owner.

Ont., Thorold—Superior Paper Co., Ltd., J. C. Cathcart, Mgr., Ormond St., plans the construction of a new electrically operated plant. Estimated cost $100,000.

Que., Drummondville — Canadian Celanese Ltd., awarded contract for the construction of a plant to the Foundation Co. of Canada, Ltd., 224 St. James St., Montreal, total estimated cost $7,000,000.

Que., Limoilou—Anglo Canadian Pulp & Paper Co., Ltd., 511 St. Catharine St. W., Montreal, will receive bids early in August for the construction of a mill here. Estimated cost $6,000,000.

Que., Montreal—Coco Cola Co. of Canada, D. S. Hawkes, Purch. Agt., Vallee St., is in the market for complete bottling and manufacturing equipment for plant, 10,000 gal. syrup daily and 5,200 cases per hour capacity.